JUNE 1953
PRICE 35 CENTS

ELECTRICAL CONSTRUCTION AND MAINTENANCE

WITH ELECTRICAL CONTRACTING

W. M. HOGUE, *Los Angeles, elected president of NISA.*

FORD *Research Center features spectacular new lighting applications.*

INDUSTRIAL TV SYSTEM *monitors utility steam plant operations.*

A McGRAW-HILL PUBLICATION | 52ND YEAR

1878 75 1953 YEARS OF ELECTRICAL PROGRESS

COMPACT CAPACITOR INSTALLATION in the Halle Bros. Company, Shaker Square store, Cleveland, Ohio, is inspected by Mr. W. L. Smith, store engineer

Saves $800 a year on a $620 capacitor investment

Halle Bros. Co. cuts power costs 19% improves power factor 20% with G-E capacitors

An installation of General Electric capacitors produced these results in the Shaker Square Branch store of Halle Bros. Company, Cleveland, Ohio, according to Milton Beyer, Building Superintendent.

Serious power losses were encountered prior to installing capacitors because of low power factor air-conditioning motor loads. In addition, a kva-demand clause in their power contract was penalizing the Company for poor power factor.

SAVINGS EFFECTED. Since installing G-E capacitors, there has been a reduction of from 18% to 20% in the total power bill. Power factor has been increased more than 20%, from 71.6% to better than 95%.

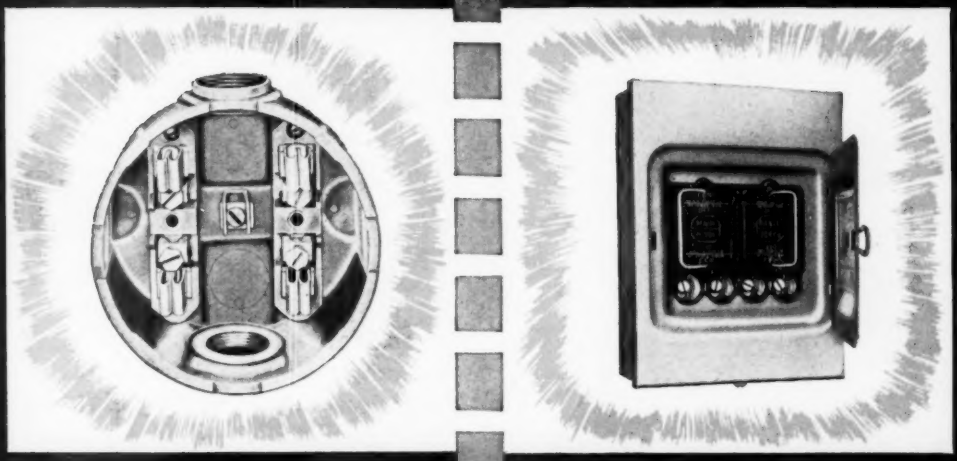
CAPACITORS PAID FOR IN 6 MONTHS. In the first six months, the capacitors saved the Halle Bros. Company more than $600. Since the total installed cost of the G-E capacitor equipment was only $620, it paid for itself in less than a year. But the savings won't stop here. As superintendent Milton Beyer puts it, "We expect to save about $800 a year from now on."

KEY TO LOWER POWER COSTS. If your power factor is below 90% and if there is a kva-demand or power-factor clause in your power contract, chances are you, too, can make worthwhile savings on your power costs by installing G-E capacitors. For additional information, consult your nearest G-E Apparatus Sales Office, or authorized agent or distributor. Or write to Section 441-102 for Booklet GEA-5632—"How to Use Capacitors to Reduce Power Costs." General Electric Company, Schenectady 5, New York. 441-102

You can put your confidence in—

GENERAL ELECTRIC

They're Designed to MATCH



And Save you MONEY

Make the job easier and quicker by using Murray matched equipment. All elements of each unit are designed to go together. Take the Murray Meter Socket and the Murray "Main and Range" illustrated. Installation is easier and quicker because knock-outs are positioned just right. Wiring is simplified because lugs are similar on both units. In addition, once installed, Murray matched equipment looks better and more workmanlike than devices from two different manufacturers.

HERE'S *Proof* THAT Murray MATCHED EQUIPMENT *SAVES MONEY!*

Levittown, Long Island (17,000 homes) is using Murray matched equipment to handle the load. Now, another large project is being developed — 16,000 homes at Levittown, Pennsylvania. Murray matched equipment is being used again!

Further proof of the advantages of matched equipment is at Fairless Hills, Pennsylvania — a project of 4000 homes. The Murray Meter Socket and the Murray "Main and Range" are back-to-back on a large percentage of these homes.

It comes down to this — Murray matched equipment saves time in installation — and time is *money*. Whether it's a huge project or a bungalow — matched equipment saves time and money.

One out of the 16,000 modern houses being built at Levittown, Pa. Murray Meter Socket is located on outside wall, rear. Murray "Main and Range," located in a utility closet, backs it up on the inside.

Electricians like Murray equipment because it's easy to install. There's always plenty of wiring room in Murray equipment!

MURRAY MANUFACTURING CORPORATION

1250 Atlantic Avenue, Brooklyn 16, New York

Service Entrance & Meter Equipment • Magnetic Hydraulic Circuit Breakers • Safety Switches (Types A, C & D) • Current Limiting Reactors • Crows'nest Aerial Ladders

Re-lamp

or convert to higher wattages

in Seconds

Patent Applied For

Takes *Less Than a Minute*
to Change APPLETON AA-51
Explosion-Proof Lighting Fixtures!

Appleton AA-51 Explosion-Proof Lighting Fixtures are so easy to change, so easy to convert from one wattage to another, it takes only seconds! So safe they can be changed without danger—*even if current should accidentally be left on!*

Fixture units are light-weight, compact, easy to store. Entire unit changes—no parts to assemble. Can be stocked with 60, 100, 150, 200, 300 and 500-watt bulbs. Appleton AA-51 Explosion-Proof Lighting Fixtures meet all requirements of Underwriters' Laboratories for Class I, Groups C and D, hazardous locations.

(1) Ceiling mounting illustrated; also available in pendent, long bracket and short bracket mounting.

(2) Standard dome reflector; also available with deep bowl, shallow dome and 30° angle reflectors.

(3) Carrying handle attaches easily, affords safe and convenient grip.

Sold Through Electrical Wholesalers

APPLETON ELECTRIC COMPANY

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APPLETON Explosion-Proof Equipment

Published for electrical contractors, industrial electricians, engineers, consultants, inspectors and motor shops. Covering engineering, installation, repair, maintenance and management, in the field of electrical construction and maintenance.

ELECTRICAL CONSTRUCTION AND MAINTENANCE

with which is consolidated Electrical Contracting. The Electrogist and Electrical Record. Established 1901

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JUNE 1953 • Vol. 52, No. 6

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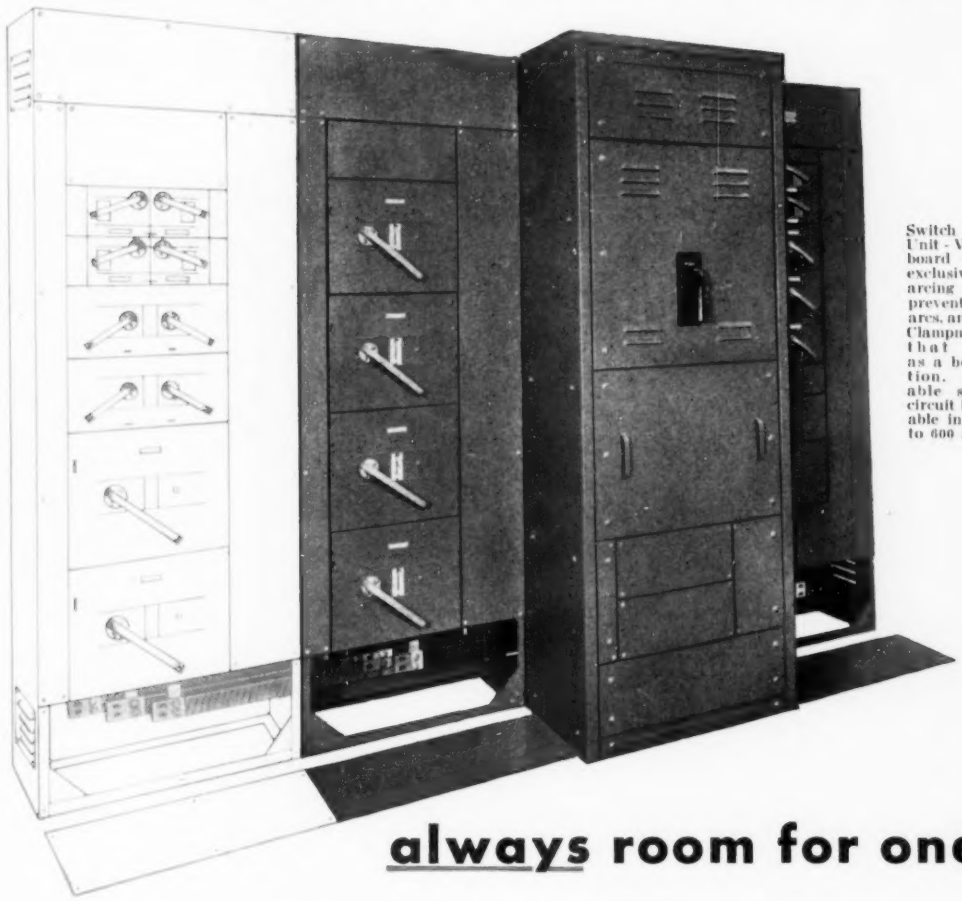
BULLDOG UNIT-VERSAL SWITCHBOARD



Switch units in the Unit-Versal Switchboard use BullDog's exclusive Vacu-Break arcing chamber that prevents dangerous arcs, and the patented Clampmatic Contacts that hold tight as a bolted connection. Interchangeable switches and circuit breakers available in sizes from 15 to 600 amperes.

always room for one more

Get the performance and protection you need *today*, the flexibility you'll need *tomorrow*, in one compact, low-cost switchboard. BullDog Unit-Versal Vacu-Break Switchboards are engineered to your specifications — adapt or expand swiftly to fit changing power requirements.

Only a screw driver and a crescent wrench are needed to assemble, install, extend or convert these modern switchboards. Removable front plates (shown above) provide quick access to wire gutters; louver plates permit bus bars to be extended and connected easily.

BullDog's famous Vacu-Break Switch Units give you extra-safe "quick-make, quick-break" protection. Furthermore, ample space can be provided for additional switches, breakers, meters, transformers, motor controls or any other special equipment you may need.

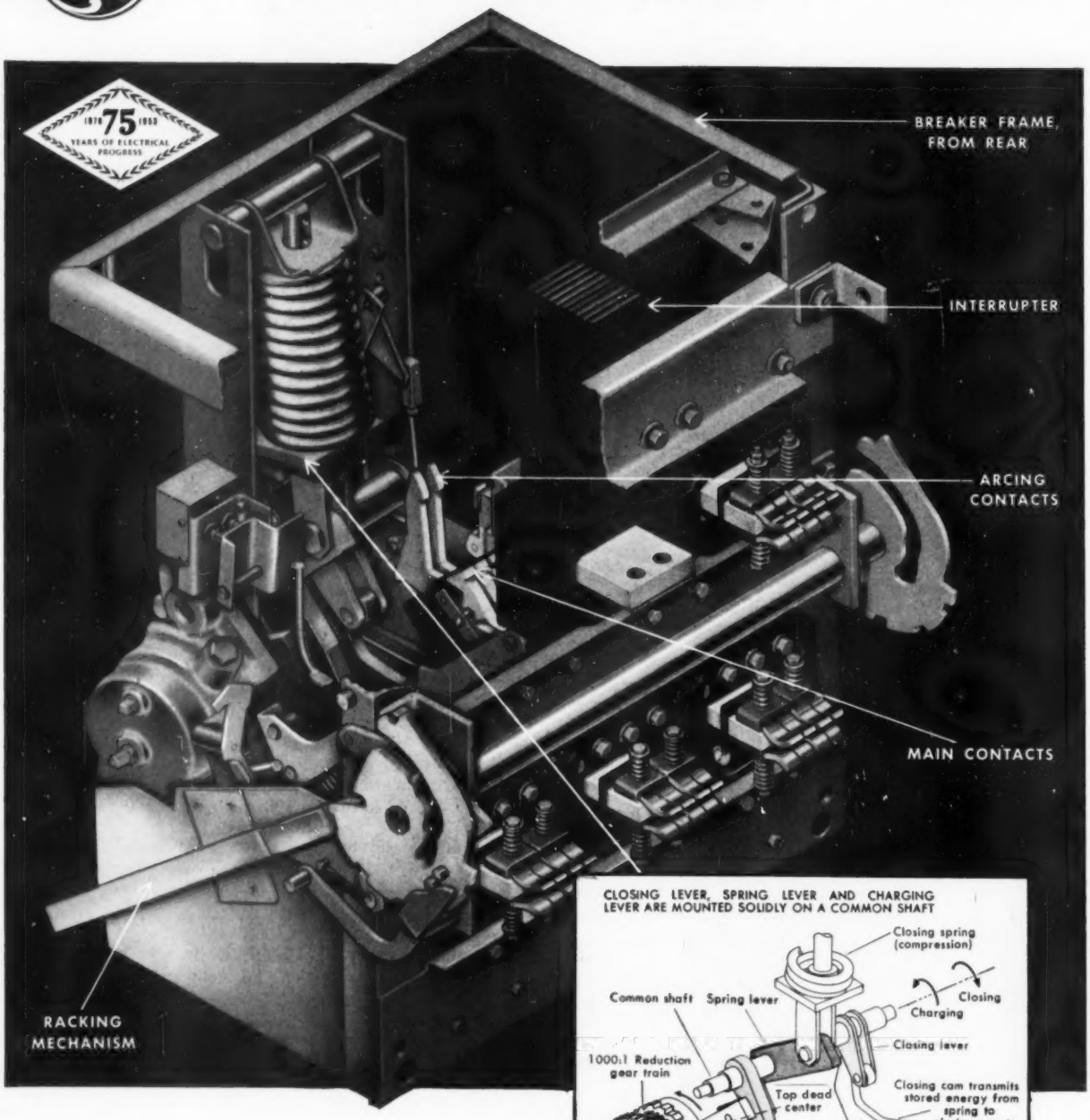
Get complete details on this amazing switchboard that lets you budget your power expansion. Write BullDog Electric Products Company, Dept. EC-63, Detroit 32, Michigan.

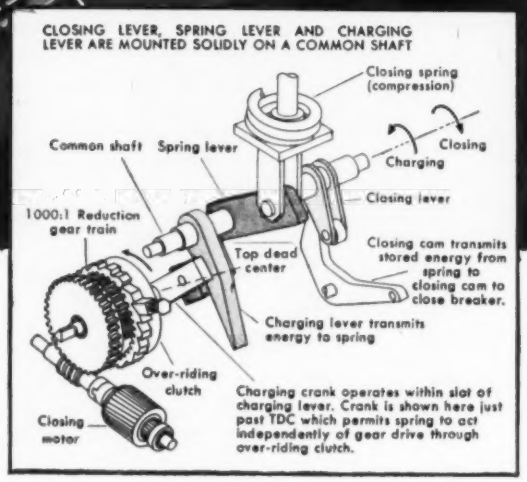
©BEPCO

BULLDOG

THOROUGHBRED IN ELECTRICAL EQUIPMENT ELECTRIC PRODUCTS COMPANY

New air circuit breaker closes




CLOSING LEVER, SPRING LEVER AND CHARGING LEVER ARE MOUNTED SOLIDLY ON A COMMON SHAFT
Closing spring (compression)
Common shaft
Spring lever
Closing
Charging
Closing lever
1000:1 Reduction gear train
Top dead center
Closing cam transmits stored energy from spring to closing cam to close breaker.
Charging lever transmits energy to spring
Over-riding clutch
Charging crank operates within slot of charging lever. Crank is shown here just past TDC which permits spring to act independently of gear drive through over-riding clutch.
Closing motor

THIS COMPACT AK BREAKER, shown in cutaway, is closed by sturdy spring of stored-energy closing mechanism at right. Spring is charged by small motor through system of reduction gears. Motor drives crank beyond dead center, where spring force takes over to close the breaker. Motor continues to recharge spring for next closing operation.

by *energy* stored in a spring!

Positive, high-speed spring closing mechanism closes breaker circuit under all fault conditions

On General Electric's new AK-1-50, -75, and -100 breakers, with interrupting ratings of 50,000 . . . 75,000 . . . and 100,000 amperes, the stored-energy, spring-operated mechanism combines advantages of the high-speed solenoid and the low-energy motor closing mechanisms.

This type of closing mechanism, introduced for the first time by General Electric to the low-voltage breaker field, operates from energy stored in a closing spring. The stored energy assures high-speed, positive closing and latching even against full interrupting current rating, even though control power is lost during closing operation.

Type AK breakers are available in all ratings from 225 to 4000 amps. continuous current, and 15,000 to 100,000 amps interrupting ratings, with 30-cycle momentary ratings equal to full interrupting ratings.

Outstanding design features of the new AK breakers are highlighted by three G-E exclusives—

Stored-energy closing mechanism—safer, sure closing even though control power is lost. G-E exclusive.

Selective operation—up to full interrupting rating, another G-E exclusive.

Toggle-linkage, exclusive with G.E., positively locks contacts in closed position even against short circuit forces.

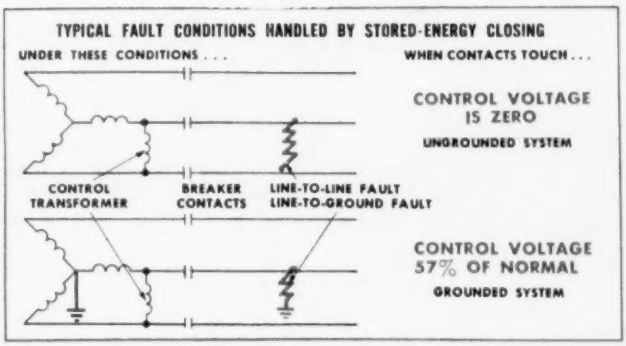
Interchangeable parts—on new breakers cut down your parts stocking problem.

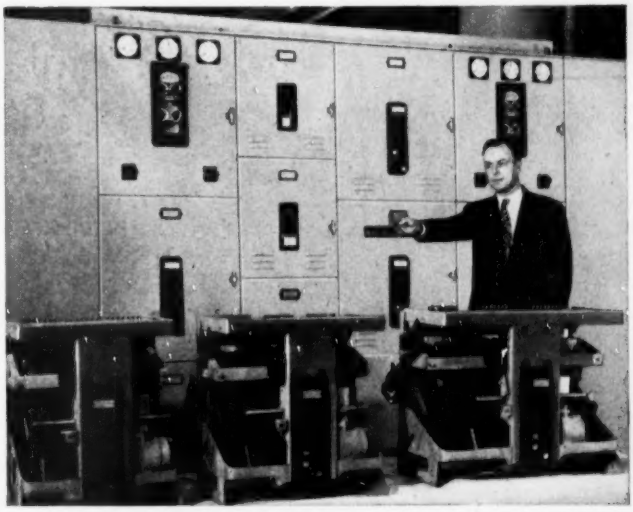
Racking mechanism—is part of breaker and permits inspection away from live parts.

New equipments—designed and tested to withstand up to 100,000 amps. Design improvements give you many new features and benefits.

New breaker-handling windlass—is designed as integral part of units. Optional for both indoor and outdoor equipments.

For details on the new AK breakers ask your local G-E sales representative for Bulletins GEA-5915 and GEA-5916, or write to General Electric Company, Schenectady 5, N. Y. 873-2



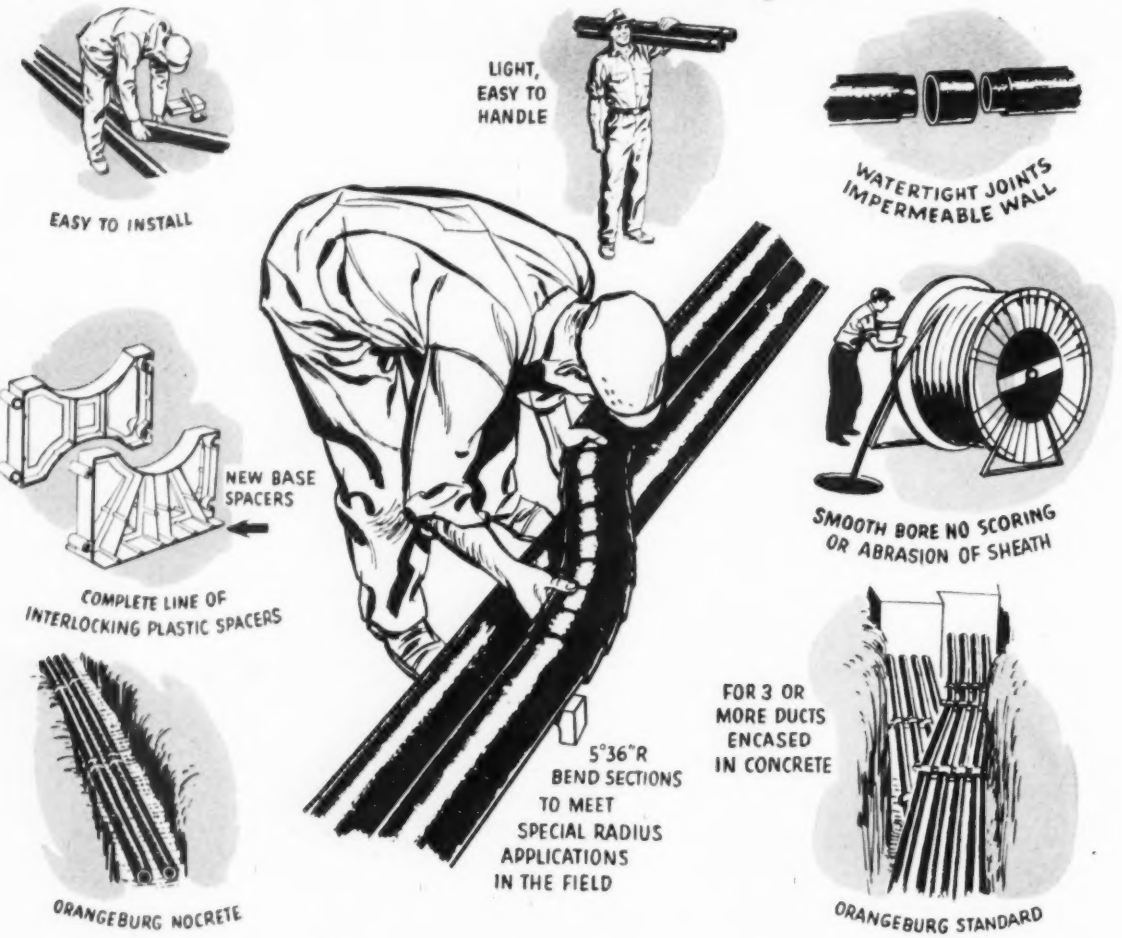


G.E.'S THREE NEW BREAKERS—The AK-1-50, AK-1-75, and AK-1-100 air circuit breakers, left to right above, vary only in width for different copper sections. These units complete AK line—make ratings available now from 15,000 to 100,000 amps. Breaker design has been completely co-ordinated with design of new G-E drawout switchgear equipments.

You can put your confidence in—

GENERAL ELECTRIC

1893 — 60th Anniversary — 1953


EASY TO INSTALL
LIGHT, EASY TO HANDLE
WATERTIGHT JOINTS IMPERMEABLE WALL
NEW BASE SPACERS
COMPLETE LINE OF INTERLOCKING PLASTIC SPACERS
SMOOTH BORE NO SCORING OR ABRASION OF SHEATH
5°36"R BEND SECTIONS TO MEET SPECIAL RADIUS APPLICATIONS IN THE FIELD
FOR 3 OR MORE DUCTS ENCASED IN CONCRETE
ORANGEBURG NOCRETE
ORANGEBURG STANDARD

Good For You . . . Good For Your Customer
Orangeburg Fibre Conduit

More and more contractors now install Orangeburg Fibre Conduit. They are convinced that it saves them money—gives them a better net profit. They have found out by experience that Orangeburg lays faster and at lower cost than any other type of conduit. They know that it saves time and work for their men in the field. Therefore it's good for you, the contractor, to specify Orangeburg—a leader in every city and state.

Orangeburg is good for your customer, too. It is strong yet tough and resilient—withstands shocks and settlements without rupturing. Non-metallic, it resists the acids, alkalies, salt and oils prevalent in ground waters. Orangeburg lasts indefinitely—gives electrical underground cables complete protection at minimum cost. Your customers want quality installations—and that's what they get when you use Orangeburg. Send to Dept. EC63, for Bend Section Folder. Orangeburg Manufacturing Co., Inc., Orangeburg, N. Y.

ORANGEBURG®
FIBRE CONDUIT

STANDARD INSTALLED WITH CONCRETE

NOCRETE INSTALLED WITHOUT CONCRETE

Graybar ELECTRIC COMPANY

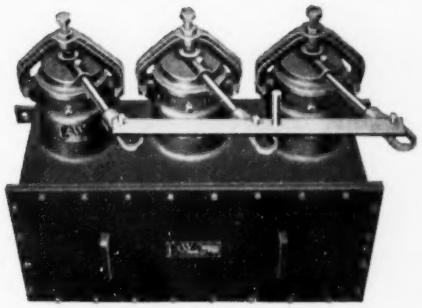
DISTRIBUTORS, ORANGEBURG FIBRE CONDUIT

BRANCHES AND STOCKS IN PRINCIPAL CITIES

GENERAL ELECTRIC SUPPLY COMPANY

A DIVISION OF GENERAL ELECTRIC DISTRIBUTING CORPORATION

CAST STEEL TANK (HERMETICALLY SEALED—OIL FILLED) PROTECTS MEN AND EQUIPMENT BY SAFELY WITHSTANDING HIGH PRESSURES OF HIGH VOLTAGE FUSE CLEARING A HEAVY SHORT CIRCUIT



"FC" OIL FUSE CUTOUTS

2500 — 5000 — 8000 VOLTS

In addition to the main purpose—a pressure tight enclosed fuse—the device serves as a full load break oil switch. The gang operating mechanism provides for three phase sectionalizing. The switching contacts are Beryllium copper. Fuse links are simple and inexpensive, easily replaceable in the carrier on the removable cover of the cutout tank.

Welded steel boxes with cutouts on top, enclose connections to feed and load circuits.

Bulletin CA52 gives data and prices. Write for a copy or ask your representative.

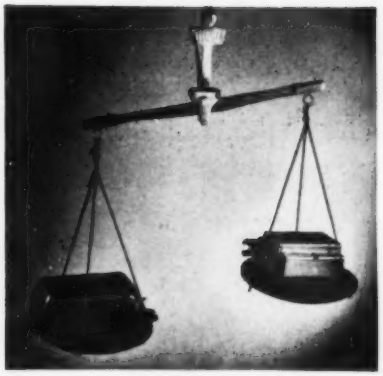
G&W "Forethought" CD1-S shows how "FC" cutouts are combined with "RAL" oil switch. Send for your copy, there is no obligation.

G & W ELECTRIC SPECIALTY CO.

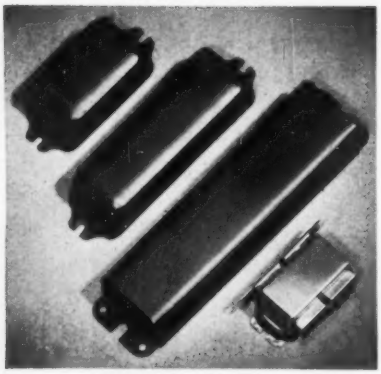
7780 Dante Avenue, Chicago 19, Illinois

Cable Terminating, Connecting and Sectionalizing Devices
Representatives in principal cities of U.S.A.
In Canada—Powerlite Devices, Ltd., Toronto and Montreal

SMALLER . . .



LIGHTER . . .



REPLACES 3 . . .

How to get smaller, quieter fixtures with the new G-E Clamped Core Ballast

You can reduce the weight, size and noise level of your small fluorescent fixtures by equipping them with General Electric's new clamped core ballast.

You can streamline your ballast stocks and simplify your ordering because the new clamped core ballast is designed to replace up to nine previous G-E ratings (three case sizes).

You can solve design and production problems with the compact clamped core ballast because its universal mounting clamp allows you to install it in any position.

And for partially open fixtures which must meet "suitability of enclosure" requirements for U.L. listing, you can order G.E.'s clamped core ballast with a metal lock-on cover.

The lock-on cover is a unique feature of G.E.'s clamped core design. It lets you incorporate savings in size, weight and cost into nearly every type of small fluorescent fixture except those which are "open" or "wide open"—that is, where the ballast is directly exposed either to air or to the fixture mounting surface.

In sign applications, the G-E clamped core ballast with lock-on cover is considered by Underwriters' Laboratories to be an enclosed unit, and can be used as encased and compounded units have been used previously. Most other small fluorescent fixtures which have reasonably close fitting joints and seams and no openings except those needed for assembling and mounting can use the clamped core ballast with no extra cover whatever.

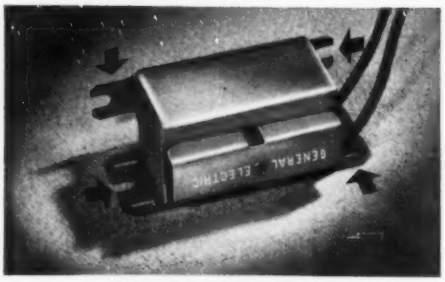
1878 75 1953 YEARS OF ELECTRICAL PROGRESS

For detailed information on how you can use the new G-E clamped core ballast to make your fixtures smaller, lighter, and quieter, contact your nearest G-E Apparatus Sales Office or authorized G-E Distributor. Or write for Bulletin GED-1868; address Section 412-104, General Electric Company, Schenectady 5, New York.

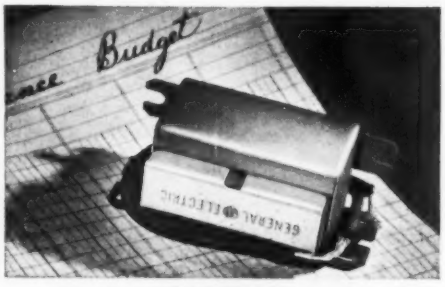
You can put your confidence in—

GENERAL ELECTRIC

QUIETER . . .



EASIER MOUNTING . . .



COSTS LESS

EASY TO INSTALL!

- **Convenient handling** . . . improved materials and compact design result in a small, lightweight transformer that can be easily handled.
- **Plenty of work space** . . . big, roomy wiring compartment for connecting system cables. Conduit knockouts are provided.
- **Fast hookup** . . . solderless clamp-type connectors that reduce hookup time to minutes are available on sizes 15 to 50 kva inclusive, single phase; sizes 45 to 112½ kva inclusive, three phase.

Get these benefits

All-welded case gives you complete protection. No additional enclosures or vaults are required. Surface finish is resistant to corrosion by acids, vapors, or moisture. Surface is Spra-Bonderized. Three coats of alkyd-resinous paint are then separately baked on.

Let Allis-Chalmers Class "B" dry-type transformers furnish full voltage at the load. To get complete information, contact your nearby Allis-Chalmers district office or write — Allis-Chalmers, Milwaukee 1, Wis.

A-4033

DESIGN ARRANGEMENTS

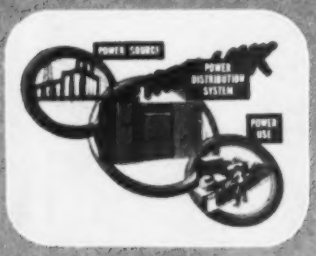
KVA SIZES		MOUNTING ARRANGEMENT	TERMINATIONS
SINGLE PHASE	THREE PHASE		
3 5 10	9 15	WALL MOUNTING LUGS	BOTTOM TERMINAL COMPARTMENT WITH REMOVABLE FRONT PLATE
15 25	30	WALL MOUNTING LUGS AND BASE FOR PLATFORM MOUNTING	TOP TERMINAL COMPARTMENT WITH REMOVABLE COVER
37½ 50 75 100 167	75 112½ 150 225 300	BASE FOR PLATFORM MOUNTING	TOP TERMINAL COMPARTMENT WITH REMOVABLE COVER

ALLIS-CHALMERS

1878 75 1953
YEARS OF ELECTRICAL PROGRESS

GENERAL ELECTRIC
Presents
THE VITAL LINK

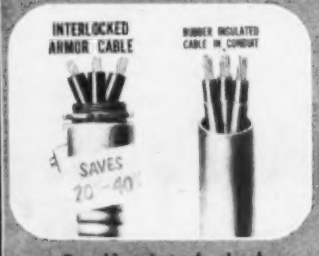
a new G-E sound color slidefilm



MODERN POWER SYSTEM
provides
GREATER RELIABILITY
GREATER FLEXIBILITY
HIGH DEGREE OF SAFETY

New sound color slidefilm . . shows how modern practices keep costs down and production up

1. Use load-center distribution



6. Use Interlocked Armor Cable

. . . and Plug-in Busway

7. Use d-c load-center systems

8. Apply Capacitors

20 minutes of modern ideas can save you thousands of plant electrical dollars

- ASSURED POWER CONTINUITY
- REDUCED INSTALLATION AND OPERATING COSTS
- FAST, EASY SYSTEM PLANNING
- PROTECTION FOR PERSONNEL AND EQUIPMENT

This new film gives a summary of the most advanced thinking in the field of plant distribution engineering in the last 10 years.

If you haven't made any changes in your plant electrical system during this period, you are probably losing thousands of power dollars each year. If you are planning expansion or modernization, then this film is even more important.

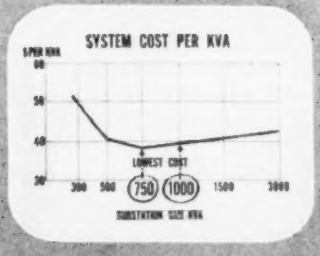
The 20-minute film, together with a 28-page Industrial Power Distribution Idea Book, will bring you up to date on the most recent engineering developments in power distribution. The film examines and evaluates a dozen ideas in this field—ideas that will help you *plan* your system from the beginning . . . *reduce* distribution costs . . . *maintain* power continuity . . . and *safeguard* both personnel and equipment.

To follow-through, you can call on your consulting engineer, your utility's industrial power sales engineer, and General Electric's sales engineer. They will help you plan and install your system—from metal-clad switchgear to load-center unit substations.

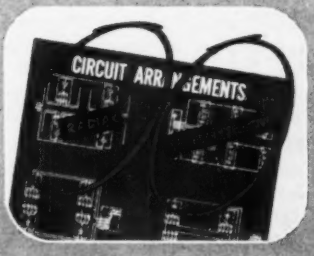
YOU CAN ARRANGE A SHOWING AT YOUR PLANT of "The Vital Link" through your nearest G-E apparatus sales representative. General Electric Co., Schenectady 5, New York. 881-2

You can put your confidence in—

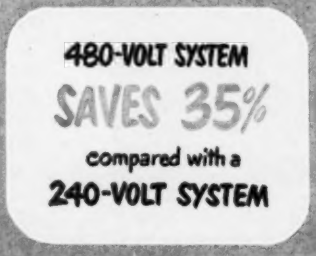
GENERAL ELECTRIC



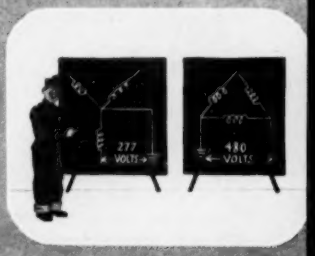
2. Choose economical substation size



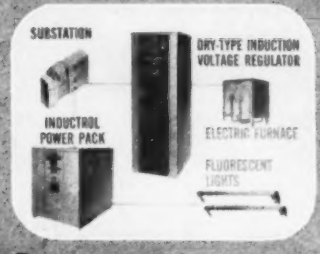
3. Select simple circuit arrangements



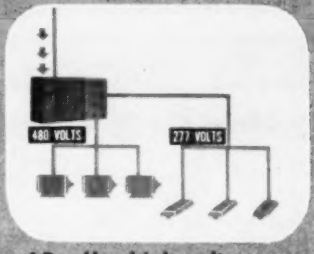
4. Select high primary and secondary voltages



5. Use system neutral grounding



9. Reduce voltage spread



10. Use high-voltage fluorescent lighting

AVAILABLE SHORT-CIRCUIT CURRENT
(SECONDARY RATING 480 VOLTS, 3-PHASE)

Available Primary 3-Phase Short-Circuit KVA	Substation KVA Rating			
	150	500	750	1500
	Low-Voltage Short-Circuit Currents 1000 Amps			
50,000	5.6	15.5	20.6	35.6
150,000	5.8	17.1	23.3	43.8
500,000	5.9	17.8	24.5	47.9
UNLIMITED	5.9	18.1	25.0	50.1

11. Be sure of your "I.C."

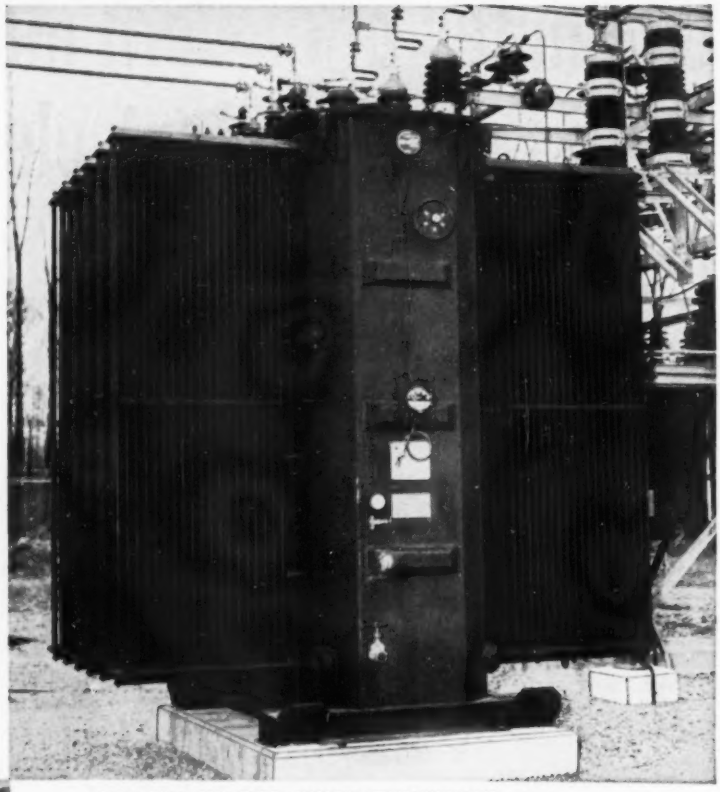
Count on

the CONSULTING ENGINEER
the ELECTRIC UTILITY
the ELECTRICAL MANUFACTURER

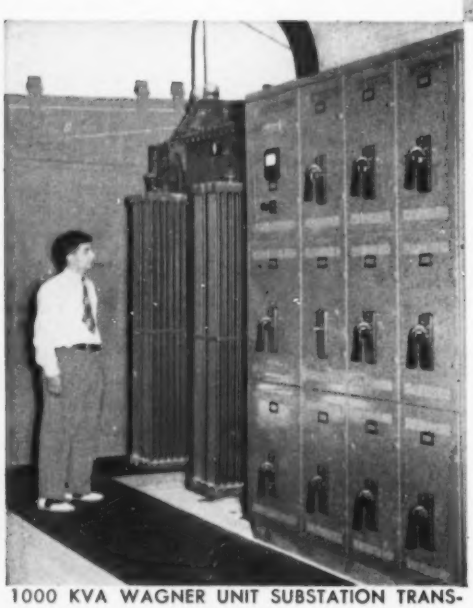
12. Take advantage of consulting services

Wagner

Transformers used by Studebaker in new power distribution system planned for present and future needs



6000 KVA WAGNER POWER TRANSFORMER where power is received at 26.4 kv and is stepped down to 13.2 kv for distribution to the seven unit substations in the plant.



1000 KVA WAGNER UNIT SUBSTATION TRANSFORMER, at one of the five load centers that deliver 440 volt, three phase power to large machines and equipment.

New Jersey plant can convert from military to auto assembly production without extensive system changes!

The modern power distribution system at the Studebaker Corporation plant at New Brunswick, New Jersey has been planned with an eye to the future. While the plant is now manufacturing military jet engine parts, it will eventually become eastern auto assembly headquarters for Studebaker.

The power load is divided between seven load center substations, all equipped with Wagner Unit Substation Transformers, spaced 160 feet apart down the center of the building. In addition to insuring an adequate power supply for present purposes, this plan provides a dependable supply of power from short secondary feeders at any time in the future.

* * *

Why not discuss your next transformer installation with the Wagner engineer nearest you? There are Wagner branches in 32 principal cities. Bulletin TU-181 gives full information on Wagner Power Transformers, and Bulletins TU-13 and TU-56 tell about Wagner Unit Substation Transformers. Write for your copies.

WAGNER ELECTRIC CORPORATION
6413 Plymouth Ave., St. Louis 14, Mo., U.S.A.

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ELECTRIC MOTORS • TRANSFORMERS • INDUSTRIAL BRAKES
AUTOMOTIVE BRAKE SYSTEMS — AIR AND HYDRAULIC

BRANCHES IN 32 PRINCIPAL CITIES

T53-9

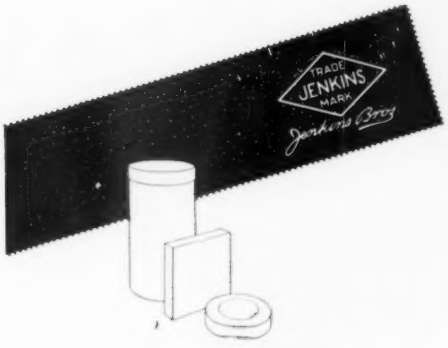
guaranteed footage ... *plus*

You get full measure with every roll of Jenkins Gold Seal Tape.

But what's even more important, every inch measures up to the Gold Seal standard, which makes every roll go further. It has lasting "tack" in any weather.

It tears evenly, does not ravel. A few wraps and the job's finished ... one thickness insulates. Get the most "coverage" per roll ... specify Gold Seal.

Jenkins Bros. (Rubber Division), 100 Park Ave., New York 17.



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In 10-roll cartons or single rolls.
Every roll sealed in cellophane, stays fresh.

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Jenkins Bros. also make
Diamond Seal Friction and Rubber Tapes
which meet ASTM Specifications.

A PRODUCT OF JENKINS BROS....

MAKERS OF FAMOUS JENKINS VALVES

Why take a big chance for a few cents?

NATIONAL ELECTRIC **A·B·C CABLE**

offers unequalled low-cost protection of your installation and your reputation

Up-to-date builders and electrical contractors

don't gamble. Sure, they want to hold construction costs to a minimum, but they know it's foolish to cut corners on wiring for a few cents and take a chance on fire hazards and high repair and maintenance bills. Their reputation is at stake.

That's why so many specify STEEL CLAD WIRING SYSTEMS of ABC CABLE for their installations.

They've learned that Steel Clad Wiring Systems provide:

Protection against shock. Steel raceways are completely grounded systems.

Protection from external mechanical damage to prevent time-consuming breakdowns.

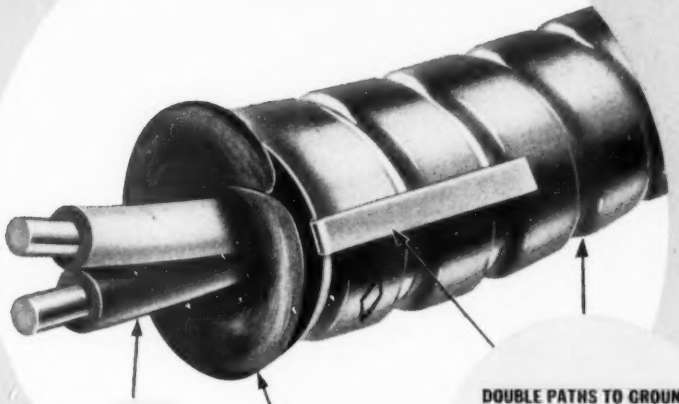
Protection against moisture.

Protection against corona cutting and breakdowns on high voltage work.

Protection against fire hazards.

Protection against tampering.

ABC provides these extra features



DILEC SAFECOTE

—insulated wires, flame retardant, moisture resistant, easy-to-strip.

ANTI-SHORT BUSHING

—protects wires from outer edges.

DOUBLE PATHS TO GROUND

on Sizes No. 14 and No. 12—(1) Flat grounding strip for continuous low-resistance path (2) Armor with "bond-hook" channel construction assures positive ground.

And they've found by experience that National Electric ABC CABLE CUTS BUILDING WIRING COSTS

ABC—complete, ready-to-use—is the fastest steel clad system to install.

ABC is easiest to handle . . . easy to install.

ABC wire and raceway are installed together.

ABC is one piece outlet to outlet.

ABC requires no special tools . . . no threading . . . no coupling and causes no waste.

Don't take a big chance for a few cents—specify safe wiring systems that offer the best protection, security and permanence—Steel Clad Wiring Systems of National Electric.

Listed by the Underwriters' Laboratories Inc. and sold through leading electrical wholesalers.

EVERYTHING IN WIRING POINTS TO

National Electric Products

PITTSBURGH, PA.

3 Plants • 7 Warehouses • 34 Sales Offices

USED THE MOST FROM COAST TO COAST

For many years Contractors from Coast to Coast have used Briegel All Steel Indenter Fittings. U. L. approved as concretetight and for general use, B-M Indenter Fittings are faster, easier to use and neater in appearance.

Installation is simple and less expensive. Two quick squeezes sets them forever. Try B-M Indenter Fittings and get more profits from each job!

Cross Section Showing Indentations.

BRIEGEL METHOD TOOL CO.
GALVA, • ILLINOIS

Distributed by

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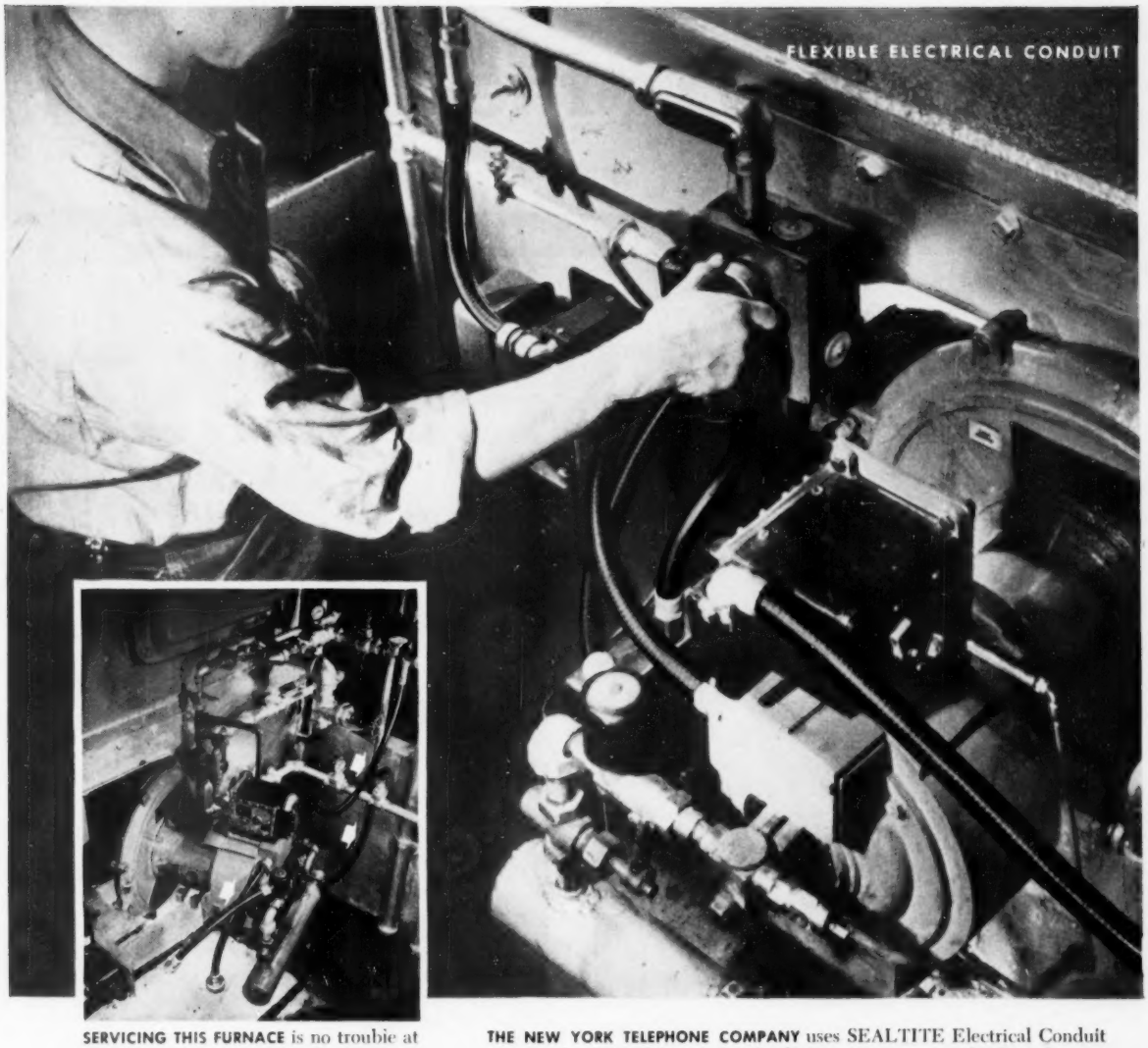


SERVICING THIS FURNACE is no trouble at all. Flexible SEALTITE Conduit permits ready opening and closing of burner.

THE NEW YORK TELEPHONE COMPANY uses SEALTITE Electrical Conduit to wire the fuel oil heater for the burner, motor power leads and transformer leads for spark igniter control wiring to Servo motors.

Telephone Company calls on durable SEALTITE when original oil burner conduit fails

To inspect or clean this furnace in the New York Telephone Company Building, they have to swing away the burner. The conduit which protects the control wiring must also move and the original conduit failed rapidly at the fittings. What licked it was a tough combination of movement, heat and abrasion. Then SEALTITE* Electrical Conduit was installed and has been working round the clock ever since, *with no sign of wear.* SEALTITE's synthetic jacket makes a much neater looking assembly, and its tough steel core stands up under mechanical abuse.

New, improved SEALTITE (Type UA) provides the best all-around protection available in a flexible conduit. Underwriters' Laboratories approves it for use in wet locations and where exposed to mineral oils (up to 60 C). A JIC-approved SEALTITE Type EF for machine tool and similar applications is also available. It bends to small radii and installs easily in cramped quarters.

Electrical Supply Houses stock SEALTITE Types UA and EF. Buy in long random lengths; then cut without waste. For descriptive booklets write: *The American Brass Company, American Metal Hose Branch, Waterbury 20, Connecticut. In Canada: The Canadian Fairbanks-Morse Company, Limited.*

*Trademark 53198

for flexible, liquid-tight electrical conduit specify SEALTITE

an ANACONDA® product

Here's On-the-Job Proof

ELECTRUNITE E.M.T.

Joining lengths of ELECTRUNITE *E.M.T. is easy. No threads to cut. Easily attached couplings make tight joints.*

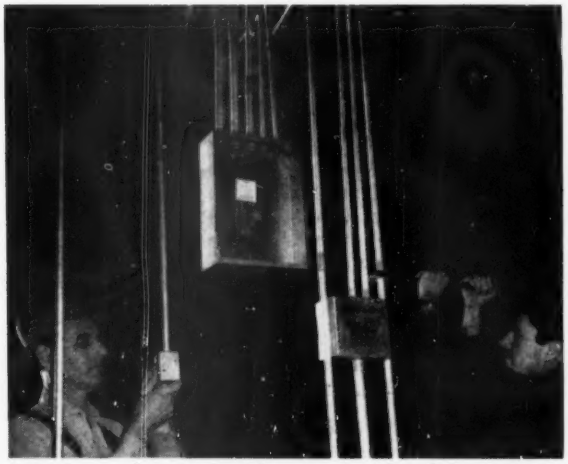
Offsets and accurate bends are made right where they're needed, using the handy reference marks on the ELECTRUNITE *bender.*

It's easier to install multiple runs in cramped spaces. Inchmarks on Republic ELECTRUNITE *E.M.T. help make accurate bends to fit in close quarters.*

Previously installed box connectors make it easy to hook up with the raceway system, even for closely spaced runs.

St. Joseph's Infirmary, Atlanta, Ga.
Abreu & Robeson – *Architects*
L. Ralph Bush & Associates – *Electrical Engineers*
Barge-Thompson Company – *General Contractors*
Eckardt-Ness Electric Co. – *Electrical Contractor*

Goes in Easy!



Lengths can be joined without turning the whole run. Because threading is unnecessary, galvanizing remains intact.

Runs are easily lined up with the box location. An experienced journeyman can turn out a neat, symmetrical job.

● There's nothing more convincing than ELECTRUNITE E.M.T. actually being installed. And the pictures on the opposite page are typical of how easy it is.

Journeymen can make smooth, accurate bends. ELECTRUNITE E.M.T. is uniformly ductile. It's "Inch-Marked™". Benders have built-in instructions, are handy to use.

Threadless fittings, connectors and couplings can be used to make tight joints. No need to turn the whole run . . . especially helpful in cramped quarters.

Wire-pulling strain is reduced . . . as much as 30 per cent . . . by the exclusive *inside-knurled* surface of the ½", ¾" and 1" sizes.

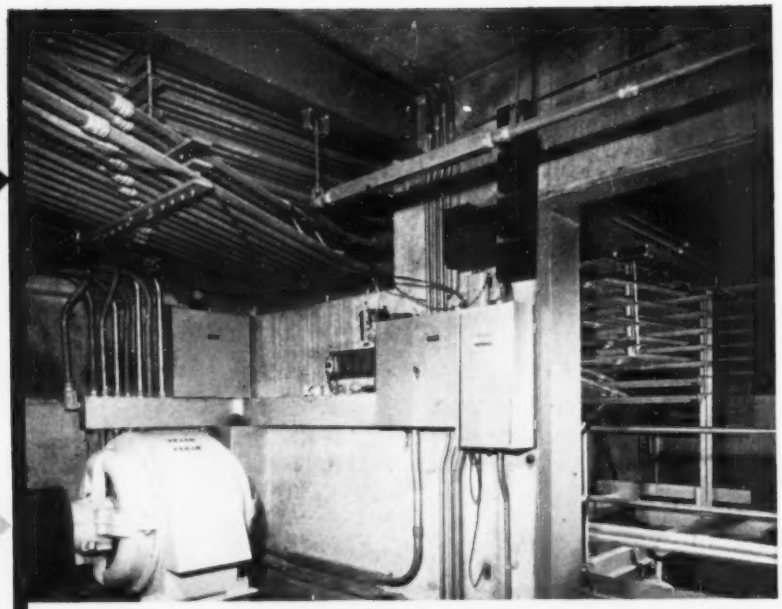
All of these features add up to easier, economical installation. ELECTRUNITE E.M.T. is approved by the National Electrical Code for concealed, exposed and concrete installations. On your next project, call your distributor and ask for Republic ELECTRUNITE . . . the "Inch-Marked" E.M.T.

STEEL AND TUBES DIVISION
REPUBLIC STEEL CORPORATION
212 EAST 131st ST. • CLEVELAND 8, OHIO

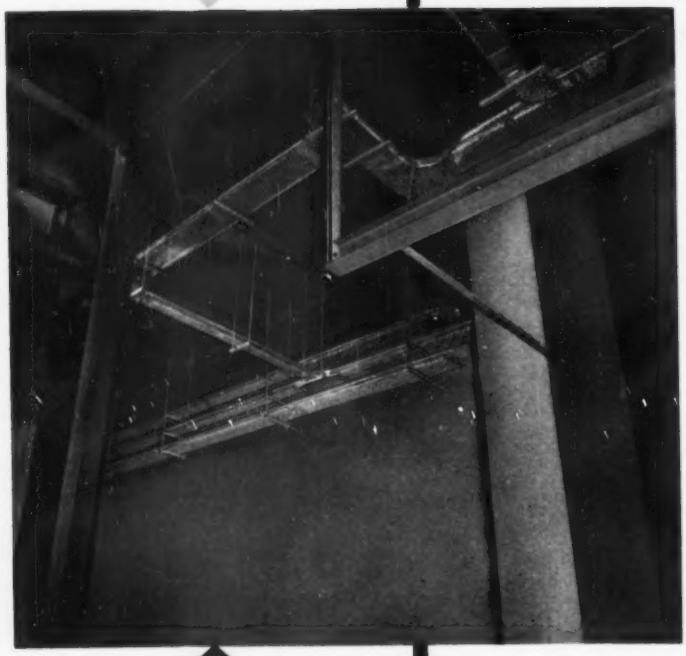
Republic
REPUBLIC STEEL
ELECTRUNITE E.M.T.

what a difference

what a saving



...with COPE CABLE TROUGH



SEEING IS BELIEVING! Here you can see at a glance the time, material and labor savings possible on cable installations through the use of Cope Cable Trough. Both of these photographs were taken at the City of Glendale (California) generating plant. The upper and older installation shows 126 - 1¼" conduits containing cables for controlling the auxiliaries for two turbine generators. Just look at the tremendous number of bends and fittings, and the complicated hanger construction needed to support this maze of conduit. You can imagine the high cost of engineering, material, and installation this entailed, even before the big job of pulling cable through the conduits was possible.

Now examine the lower, recent installation (view taken during construction) involving control of two additional generators, where cables for control conduits 480 volt auxiliary power, and 2400 volt auxiliary power are carried in Cope Cable Trough. It was a simple job to lay out and erect this trough using standard lengths and fittings. Costs were but a fraction of the older method; time and material were saved and accessibility for visual cable inspection is provided. Additional cables may be added with great ease.

You, too, can make such savings.

T.J. Cope INC.

A detailed bulletin giving all the facts about Cope Cable Trough will be sent upon request. Write for it.

You know Cope by these products

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KEYSTONE TYPE XVI COLLECTORS

Outlast Others as Much as 25 Times!

Carbon Contact Member is Non-arcing, Noiseless, Self-lubricating and Self-cleaning

Cut work stoppage and production loss due to crane collector failures. Replace your worn collectors with Keystone Type XVI Collectors. Many plants have proved these outstanding collectors actually outlast ordinary types by as much as 25 times!

Keystone Type XVI Collectors provide constant contact and longer life. Housing consists of two aluminum castings with large radiating fins to provide lower operating temperatures. For all sizes of trolley wires up to 4/0 incl.

If you have a current collecting problem in your plant, get the facts on Keystone Type XVI Collectors. Write us today for latest illustrated folder on Keystone electrical products.

ELECTRIC SERVICE MANUFACTURING CO.

PHILADELPHIA 32, PENNA.

Manufacturers of complete line of insulator supports for rail and wire conductors and current collection devices.

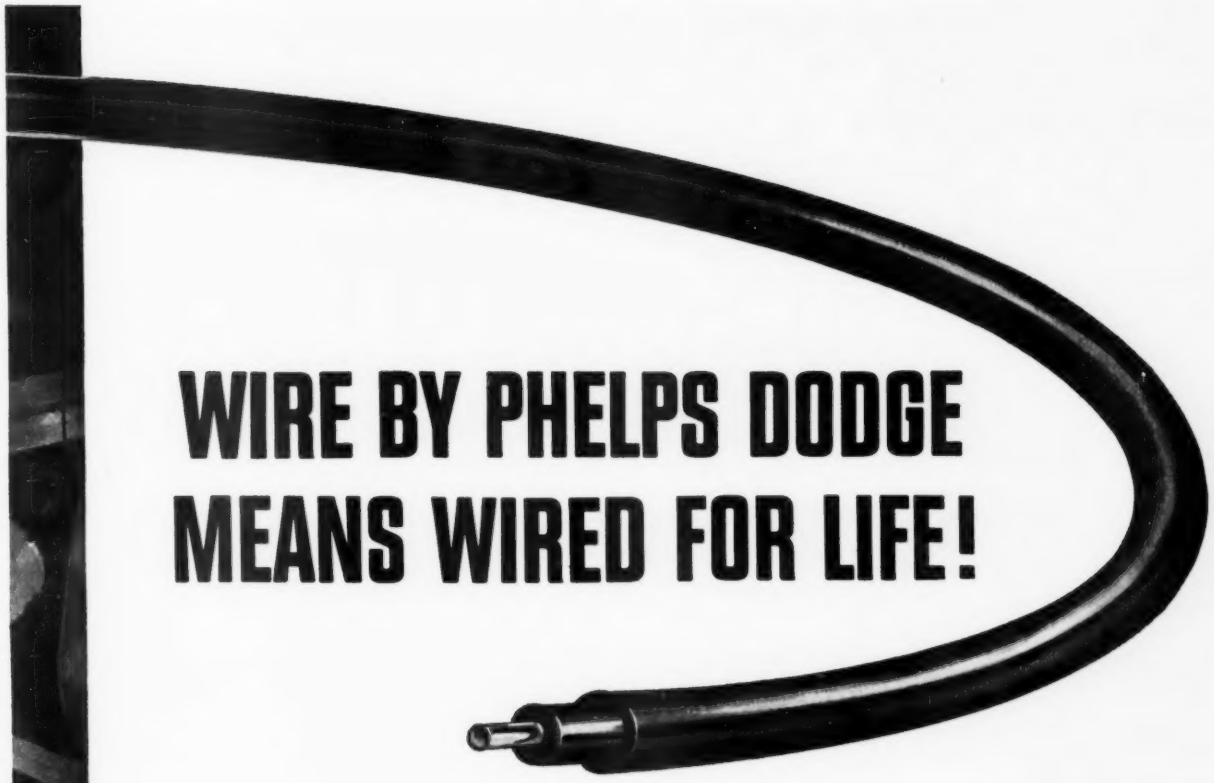
DEPENDABLE STREET LIGHTING SYSTEMS

Street lighting cable installed underground must resist severe mechanical abuse and the stresses imposed by high-voltage operation. Extra toughness and corona resistance are engineered into every foot of Habirshaw series lighting cable to assure uninterrupted service under conditions where others fail.

HABIRITE-HABIRPRENE TYPE RR series lighting cable means the very highest standards of quality and dependability under the most difficult service conditions.

HABIRPRENE (neoprene sheath) is especially compounded to resist damage from high-voltage electrical discharges and to reduce the hazards of direct burial insulation.

HABIRITE BUTYL rubber insulation is extra tough—extremely resistant to the effects of corona, ozone and mechanical abuse.



WIRE BY PHELPS DODGE MEANS WIRED FOR LIFE!

It Pays to Watch Quality—Tomorrow's Job May Depend on the Cable You Installed Today!

Selecting Habirshaw cable—a product of the Phelps Dodge Copper Products Corporation—is a sure way of guaranteeing your own reputation for highest quality work. Habirshaw standards of quality are reflected in top-grade materials, fine workmanship and over-all excellence.

See Your Phelps Dodge Distributor!

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SORGEL
AIR-COOLED Dry-Type TRANSFORMERS

for Every Purpose

¼ to 1500 Kva single phase. 1 to 3000 Kva poly-phase.
All voltages up to 15,000 volts.

Custom Built Transformers

Complete with enclosures, tap changing switches, circuit breakers, fuses, meters, etc.

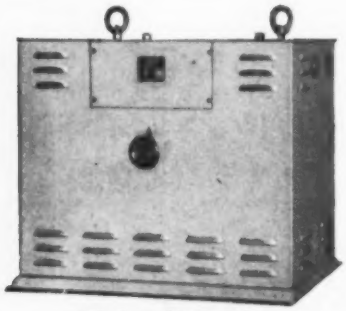
Or without enclosures for unit substations, power centers, panel mounting, or for installation with other equipment.

Reactors D.C. Saturable

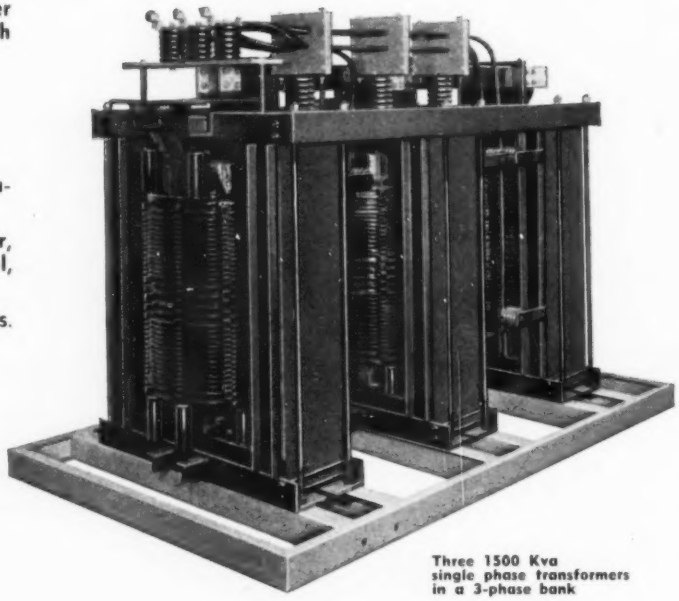
To regulate the voltage and current of any manufacturing process.

The control can be a small, simple potentiometer, with stepless adjustments, or push button control, placed in any desired convenient location.

Ask us to help you work out your requirements.



D.C. Saturable Reactor with potentiometer control



Three 1500 Kva single phase transformers in a 3-phase bank

for Unit Substations

Sales Engineers in Principal Cities

SORGEL ELECTRIC CO., 836 West National Ave., Milwaukee 4, Wis.

Pioneers in the development and manufacturing of Air-Cooled Dry-Type Transformers — Over 35 years

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BATTLESHIP GREY

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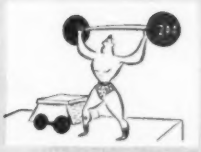
Flex

NON-METALLIC SHEATHED CABLE



TOUGHER

CLEANER TO HANDLE

SMOOTHER

EASIER TO PULL

Electricians & Contractors are Insisting on this New and Improved Columbia Flex

Approved by Underwriters Laboratories
Serving the Electrical Wholesaler Since 1912

Columbia CABLE & ELECTRIC CORP.
255 Chestnut St. Brooklyn 8, N. Y.

NON-METALLIC SHEATHED CABLE

FLEXIBLE STEEL CONDUIT

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A.B.C. ARMORED CABLE

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Philadelphia, Pa.
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Complete motor protection

FOR TIME-DELAY OVERLOAD AND SHORT CIRCUIT PROTECTION

The ET "F" frame circuit breaker, when used in conjunction with a motor protective device, provides additional time-delay protection *on each phase*, plus instantaneous short circuit protection. Thermal time-delay tripping guards against overloads. Magnetic instantaneous tripping action assures split-second interruption on short circuits.

FOR ADJUSTABLE INSTANTANEOUS SHORT CIRCUIT PROTECTION

The ETI "F" frame circuit breaker with external instantaneous trip adjustment provides short circuit and instantaneous overload protection. The instantaneous trip overload setting can be adjusted for various applications. Each breaker has five separate trip settings calibrated in even increments of the complete tripping range. When used in combination starters, circuit breaker serves in conjunction with a motor protective relay to provide complete protection.

ITE MOLDED-CASE

includes I-T-E Circuit Breakers

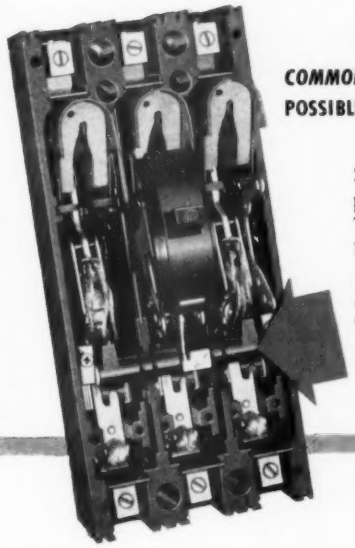
To furnish the energy for today's high-capacity production, modern plants depend on powerful motors. Motors are costly capital equipment. As such, they must receive proper maintenance and protection.

Protection against short circuits, overloads, and single-phasing rates high on the list. So be sure to use I-T-E Circuit Breakers in conjunction with your motor protective devices—for complete protection.

Depending on preference, I-T-E Circuit Breakers can be furnished with thermal-magnetic tripping characteristics for protection against overloads and short circuits, *or* with adjustable instantaneous magnetic tripping characteristics for short circuit protection.

The combination of either type circuit breaker with a motor protective device provides *complete* motor protection. Swift restoration of service—without replacement of elements—holds costly machine downtime to a minimum.

When ordering your motor control, be sure to specify: "I-T-E Circuit Breakers for use in conjunction with motor overload protective relays."



CIRCUIT BREAKERS OPERATE ON *COMMON TRIP* PRINCIPLE TO PREVENT POSSIBLE SINGLE-PHASING OF MOTORS

Suppose there's a fault on one phase of a multiphase motor. The circuit breaker tripping bar (arrow), common to all poles, releases the latch to open all poles simultaneously. There's no chance of single-phasing.

There are I-T-E Circuit Breakers and enclosures for every application—indoor and outdoor—with auxiliary and tripping devices to fit each job.

Ratings from:

10 to 6000 amperes
up to 600 volts a-c
up to 250 volts d-c

Ask your I-T-E representative for details

CIRCUIT BREAKERS

I-T-E CIRCUIT BREAKER CO. • 19TH AND HAMILTON STREETS • PHILADELPHIA 30, PA.

Model 622—Ultra-Sensitive Instruments

Portable d-c and a-c thermo instruments for precision measurement of potentials and minute currents in electronics or laboratory research.

Model 901
Portable Test Instruments

Available in d-c, Model 901—and a-c, Model 904, single and multiple ranges of wide coverage. Excellent scale readability and shielding. Accuracy within ½ of 1%.

A-C Clamp Volt-Ammeter

(Model 633, Type VA-1) For convenient and rapid measurement of a-c voltage and current without breaking the circuit. Jaws take insulated or non-insulated conductors up to 2" diameter. Safe, rugged, versatile. Also available as a-c clamp ammeter, without voltage ranges.

Specialized and Multi-purpose

INSTRUMENTS

for

- **RESEARCH**
- **PRODUCTION**
- **MAINTENANCE**

For complex, or just routine measurement jobs, these and other specialized WESTON Instruments save time and assure dependable measurements. For information on the complete line, see your local Weston representative, or write . . . WESTON Electrical Instrument Corp., 614 Frelinghuysen Ave., Newark 5, N. J.

WESTON
Instruments

Sensitive Relays

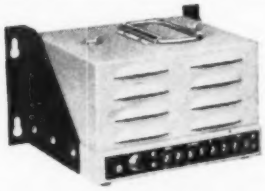
A line of sensitive relays including the Model 705 which provides positive operation at levels as low as ½ microampere. Non-chattering magnetic contacts handle up to 10 watts at 120 volts.

Panel and Switchboard Instruments

A complete line of instruments in all types, sizes and ranges required for switchboard and panel needs . . . including d-c, a-c power frequencies and radio frequency, rectifier types and D.B. meters.

Model 697 Volt-Ohm-Milliammeter

One of a line of pocket-size meters, Model 697 combines a selection of a-c and d-c current, and resistance ranges. Ideal for maintenance testing and many inspection requirements.

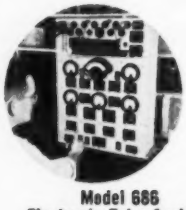


Model 1411 Inductronic D-C Amplifier

Stable amplifier provides high degree of resolution even at fractional loads. Reaches steady full scale deflection in a fraction of a second. Interchangeable plug-in range standards for either microamperes or millivolts.

Industrial Circuit Tester—Model 785

A multi-range, multi-purpose, ultra-sensitive analyzer, for laboratory and industrial checking of electrical and electronic circuits. Has 28 practical scale ranges; measures d-c and a-c voltage, d-c and a-c current, and resistance. Accessories available to extend ranges. Compact and portable; furnished in either oak or steel case.



Model 686
Electronic Tube Analyzer

Tests tubes under exact operating potentials. Accurately determines true mutual conductance of all tubes, in accordance with manufacturers' rated operating conditions, or under special operating conditions.

High Frequency Electronic Analyzer
Model 769

A three-in-one instrument providing a self-contained Volt-Ohm-Milliammeter, a high impedance electronic D-C Volt-Ohmmeter, and a probe type Vacuum Tube Voltmeter for use to 300 megacycles. Exceptionally stable and accurate. Has specially designed extremely small RF and D-C probes.

AT

TRIANGLE

IT *Must* BE RIGHT!

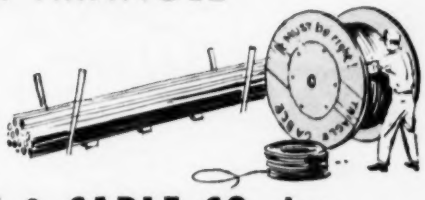
Walk into any one of Triangle's factories and the first thing to greet your eye is a sign: "It *Must* Be Right!" Then, walk between the long lines of whirling, pounding, busy machines. Every few feet you'll see those words — "It *Must* Be Right!"

That philosophy has been the order of the day at Triangle ever since the moment, back in 1916, when the wheels first began to turn. Everything at Triangle, from product through service, *must* be right.

Every day our customers benefit from this policy. Every day they get extras in quality and service they had not been able to get elsewhere.

Perhaps you too would benefit by doing business with a company who thoroughly understands its obligation to its customers.

You'll like doing business with TRIANGLE



The Trade Mark of TOP Quality

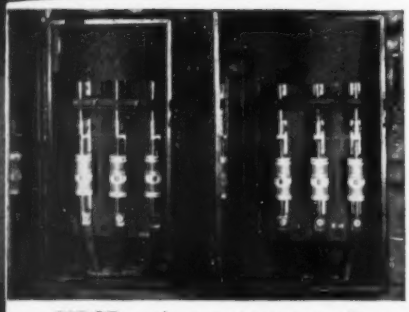
TRIANGLE

IT MUST BE RIGHT! ®

TRIANGLE CONDUIT & CABLE CO. Inc.

New Brunswick, New Jersey

When it's a Question of Carrying Electrical Power—Specify **TRIANGLE**



for FUSE ECONOMY . . . use ECONOMY FUSES

YOU SAVE 3 WAYS!

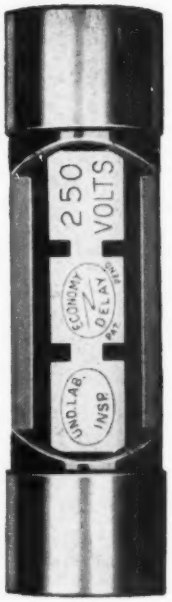
FIRST—with "ECONOMY DE-LAY" Renewable Fuses you save money every time you have a current "blow". Simply remove the blown link and replace it at the cost of only a few cents with a new, "ECONOMY DE-LAY" Renewal Link in the same cartridge.

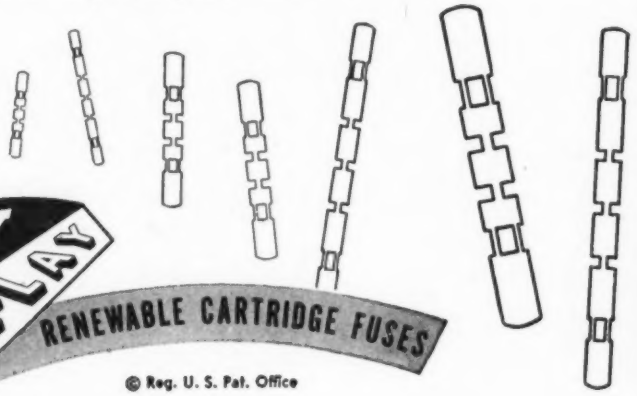
SECOND—you save because of the short time required to make this replacement—and time is money.

THIRD—you save by reducing "down time" on machines—because an inexpensive carton of Economy Fuse Renewal Links kept on hand 24 hours a day, answers fuse renewal requirements *immediately*.

Your Electrical Wholesaler has "ECONOMY DE-LAY" Renewable Fuses and Renewal Links in stock.

Ask for the Economy Catalog and Price List.





ECONOMY DE-LAY RENEWABLE CARTRIDGE FUSES

© Reg. U. S. Pat. Office

ECONOMY FUSE AND MFG. CO., 2717 GREENVIEW AVE., CHICAGO 14, ILLINOIS REPRESENTATIVES IN ALL PRINCIPAL CITIES

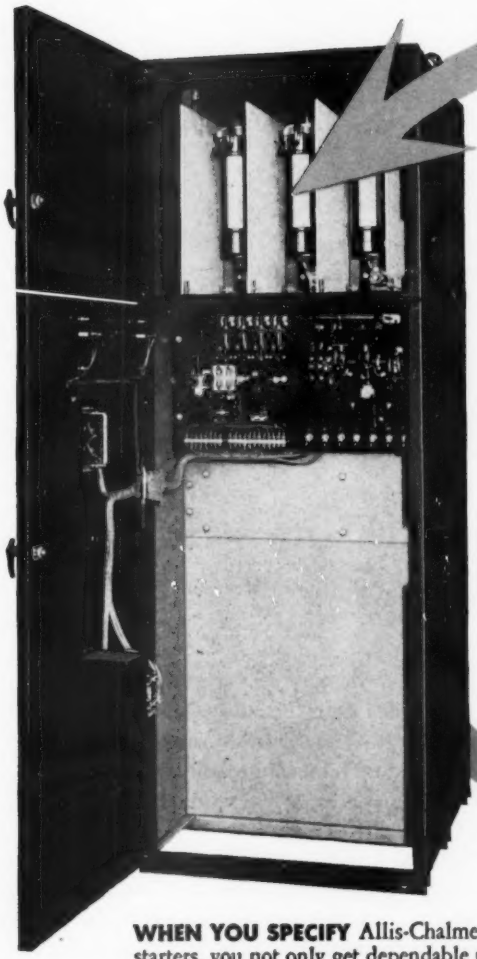
5730

ALLIS-CHALMERS

Type H Starters

FOR 2300 TO 5000 VOLT MOTORS

Give YOU Full Protection



SHORT CIRCUIT PROTECTION

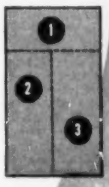
Current-limiting fuse clears short circuit in less than ½ cycle . . . long before the short has had time to harm contactor or motor. Blown fuse emits no gas, flame nor vapor, discharges no metal. Flashover caused by ionized vapor is eliminated.

OVERLOAD PROTECTION

Type 194 thermal overload relay automatically adjusts for ambient temperatures — trips only on motor overload. Prevents unnecessary motor outages. Allows use of maximum capacity, but prevents dangerous motor overloads. Can be adjusted to plus or minus 20% of rated current.

PERSONNEL PROTECTION

The steel cubicle is divided into three compartments for maximum personnel protection. 1 — Upper front compartment encloses disconnect type fuses. 2 — Lower front compartment houses low voltage control devices. 3 — Rear compartment contains high voltage equipment, contactors, buses, intrument transformers, etc.



Side View of Cubicle

TIME DELAY UNDERVOLTAGE PROTECTION

Should an undervoltage occur, the line contactor opens. During a predetermined period, relay remains closed to permit restarting of motors when power is restored.

WHEN YOU SPECIFY Allis-Chalmers Type H starters, you not only get dependable motor control, but you are assured of an all-important "plus"— FULL PROTECTION for man, motor and machine. Positive protection as engineered into Type H starters permits men to work in complete safety... protects motors and machines from costly damage . . . lengthens equipment life . . . increases production by reducing downtime. Get all the facts from your nearby A-C representative or write Allis-Chalmers, Milwaukee 1, Wisconsin. A-3982

ALLIS-CHALMERS

BUS DUCT IS FLEXIBLE

3 men install 755 ft. of BUS DUCT in 4 days at Lapointe Machine Tool Company

Secondary power distribution for a plant expansion was no problem for Lapointe Machine Tool Company, Hudson, Mass.

Westinghouse Plug-in Bus Duct was selected—and installed in record time! Three men using a fork truck completed the 755-ft. installation *in just four days.* The savings paid for an additional lighting job.

The flexibility of plug-ins every foot saved production, too. With power taken temporarily from the duct, they moved 139 machine tools with less than five minutes down time per operator.

Prefabricated in any length up to ten feet, Westinghouse Bus Duct installs easily with sliding-type cantilever hangers. Duct is fully salvageable—can be expanded or relocated readily.

Up to 5000 amperes, Westinghouse Bus Duct has greater current-carrying capacity than any system of wireway, cable or conduit. Four types are available to handle all load conditions and service requirements.

Call your Westinghouse Representative for complete details or write for B-5835, Westinghouse Electric Corp., P. O. Box 868, Pittsburgh 30, Penna.

J-30128

APPARATUS DISTRIBUTION WESTINGHOUSE

YOU CAN BE SURE...IF IT'S Westinghouse

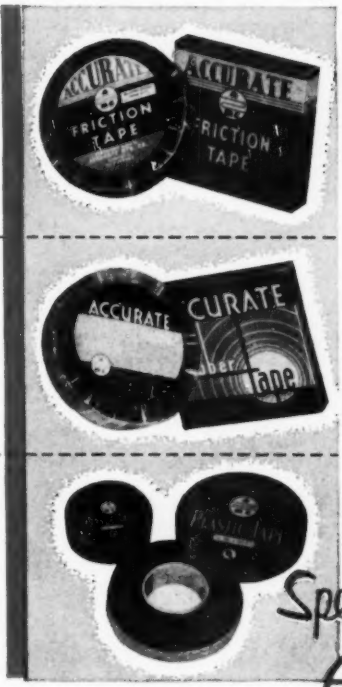
DESIGN TESTED AND VERIFIED in the Westinghouse HIGH POWER LABORATORY

-when it's taped with ACCURATE

ACCURATE FRICTION TAPE – High grade rubber carefully compounded with finest cotton base provides maximum mechanical protection for every wrap. Made in Standard and A.S.T.M.

ACCURATE RUBBER TAPE – Features high elasticity, excellent cohesion, high dielectric and super aging qualities. Available in Standard and A.S.T.M. –A.A.R. grades.

ACCURATE PLASTIC TAPE – Offers a bulk-reducing combination of thin caliper, good mechanical and dielectric strength. Recommended for use wherever plastic tape is practical.



SUPER AGING QUALITIES MAKE THE DIFFERENCE!

Electrical wraps made with Accurate Tape actually improve with age. The raw materials engineered into Accurate Tapes are selected for extra durability and maximum electrical and mechanical protection. For example, Accurate Rubber Tape features high elasticity, excellent cohesion, high dielectric and super aging qualities. No heat or extra pressure is required during application, yet the job improves with age. Whether you use Accurate Friction, Rubber or Plastic Tape, you can be sure there's no finer tape at any price . . . Accurate provides positive tape protection!

WRITE FOR NEW CATALOG—All you need to know about electrical tapes in one handy brochure. Call or write for your copies to:
ACCURATE MFG. COMPANY, GARFIELD, N.J.

Specify **ACCURATE**

YOUR BEST BUY IN TAPE!

MORE THAN A QUARTER CENTURY OF TAPE SPECIALIZATION

"Toughest operating but the first batch of

THIS IS A TYPICAL DRILL. It uses a 4-conductor No. 8 Amerclad cable.

Says Chief Electrician, Hudson Plant,
Universal Atlas Cement Company

● Year after year, at this quarry, the Amerclad is exposed to knife-sharp fragments of flying rock. During the summer, the rock often gets so hot that you can't even touch it. Other times, the cable lies out in the rain and snow— often at sub-zero temperatures.

At the Hudson, N. Y. quarry of Universal Atlas, Chief Electrician Frank Rodmond said, "This Amerclad runs the constant danger of being hit with flying rock fragments through secondary blasting. Yet the down-time cost of this operation is so high that we just can't stand cables that keep failing. We kept that last batch of Amerclad 12 years before we replaced it, yet it was still serviceable when we switched over to new Amerclad."

If you want service like this, specify Amerclad the next time you need cable that can really take it. Amerclad is available in a great many sizes and constructions, with or without shielding. There is a type to power anything from a river dredge or mine locomotive down to a rough and tumble electric hand drill. *Send the coupon,* and get more information.

AMERICAN STEEL & WIRE DIVISION
UNITED STATES STEEL CORPORATION
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A STANDARD Cable for

- **paper & varnished cambric cable**
- **asbestos wire and cable**
- **aerial, underground & submarine cable**
- **shovel & dredge cable**

U·S·S AMERICAN ELECTRICAL

condition in our quarry— Amerclad lasted 12 years"

NOTICE THE CABLE TRAY fastened to the shovel. This was developed by Universal Atlas for easier cable handling—it also prolongs life of the cable.

HERE A CABLE is raised on horses to clear the railroad track. It feeds the shovel visible in background.

TWO WORKMEN WATCH from blast shelter as charge is set off in distance. Low horses cushion cable from shock of falling rock in secondary blast areas.

every ***SPECIAL*** *Job!*

- mold cured portable cord
- machine tool & building wire
- special purpose wire & cable

WIRE & CABLE

SEND THE COUPON

American Steel & Wire Division
Room AE-63, Rockefeller Building
Cleveland 13, Ohio

☐ Please give me more information about Amerclad.
☐ I'd like to talk to your representative.

Name .....

Firm .....

Address .....

City ..... State .....

USS

UNITED STATES STEEL

THE MAKERS OF THE WORLD-FAMOUS AMPROBE NOW BRING YOU THE

NEW AMPROBE JUNIOR

VOLT-AMP TESTER

$19.85

INCLUDING VOLTAGE TEST LEADS

ACTUAL SIZE

One pocket tester does the complete job

IT'S A SNAP-AROUND AMMETER
Measures current instantly without shutdowns or breaking of insulation for ammeter connections.

IT'S A VOLTAGE METER
Measures voltage quickly, accurately on a full-sized calibrated scale; eliminates guesswork.

Gives you tester ruggedness with instrument accuracy (within ± 3% of full scale)

PICK THE RANGE THAT FITS THE JOB:

MODEL "10": 0- 10 AMPS A-C 0-125/250 VOLTS A-C
MODEL "25": 0- 25 AMPS A-C 0-125/250 VOLTS A-C
MODEL "50": 0- 50 AMPS A-C 0-125/250 VOLTS A-C
MODEL "100": 0-100 AMPS A-C 0-125/250 VOLTS A-C

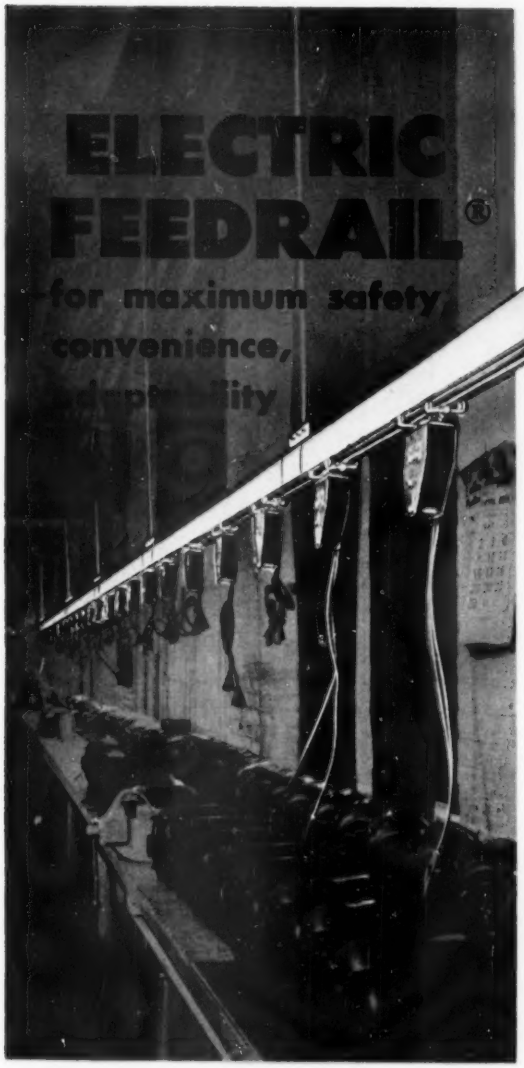
Now every electrical man can be equipped with a snap-around volt-ammeter. The Amprobe Junior is similar to the world-famous Amprobe, except that it is built to fit a specific job at low cost. For only a few dollars more than just a voltage tester, you get an *accurate* voltage meter *and* a prized snap-around ammeter. Pays for itself the first month alone by eliminating guesswork and time-wasting connections. Write today for Catalog No. 132. Pyramid Instrument Corp., Lynbrook, N. Y. (Export Div.: 458 Broadway, N. Y. 13. Cable: Morhanex).

IF YOUR JOB CALLS FOR A MULTI-RANGE AMPROBE:

AMPROBE "300"
0-6/15/30/60/150/300 AMPS AC.
0-150/300/600 VOLTS AC.
$49.50 COMPLETE WITH LEATHER CASE AND VOLTAGE TEST LEADS.

AMPROBE "600"
0-15/30/60/150/300/600 AMPS AC.
0-150/300/600 VOLTS AC.
$59.50 COMPLETE

AMPROBE "1200"
0-15/60/150/300/600/1200 AMPS AC.
0-150/300/600 VOLTS AC.
$67.50 COMPLETE



Power Outlets every inch of the way

The smooth-rolling trolley outlets can tap power at any point along the entire length of a run. Electrical outlets are always available where or when you need them when ELECTRIC FEEDRAIL is on the job. Additional trolleys can be added in a matter of minutes without shutting off power. If you're planning a plant addition, a revised production set-up, or a new plant—remember that FEEDRAIL is the electric power distribution system you can't afford to overlook. A FEEDRAIL engineer or field representative will be glad to provide you with details. Call him in today.

Write for descriptive literature which gives you full details about ELECTRIC FEEDRAIL, including facts and data on capacities, installations, and the preparation of specifications.

Sold by leading electrical distributors

52-2 Rev

ELECTRIC FEEDRAIL®

Never Becomes Obsolete

FEEDRAIL CORPORATION

Subsidiary of Russell & Stoll Company, Inc.

125 BARCLAY STREET • NEW YORK 7, N. Y.

SPECIALLY QUALIFIED REPRESENTATIVES IN PRINCIPAL CITIES

LIKE THE BAMBERGER-REINTHAL CORPORATION, CLEVELAND—YOU, TOO, CAN . . .

Modernize Your Equipment With New G-E Gear-motors

The Bamberger-Reinthal Corporation of Cleveland, Ohio recently converted to new G-E Gear-motors for machines knitting sweaters, shirts, stoles, and caps. Bamberger-Reinthal says: "These new G-E Gear-motors are much more efficient than our previous drive. They're the latest thing as far as we're concerned, and they're less expensive to operate and maintain."

G-E Gear-motors will modernize your operation too! Here's why:

G-E GEAR-MOTORS ARE COMPACT, requiring only a little more space than a regular constant-speed motor of the same rating. No external speed reduction equipment is necessary.

G-E GEAR-MOTORS ARE RUGGED. They're engineered to give you years of dependable service under the most severe operating conditions.

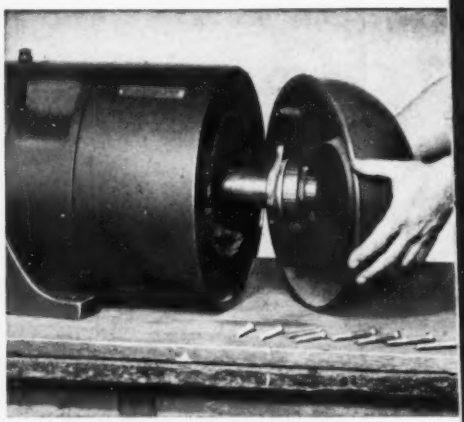
Assure yourself of getting the most efficient, easiest-to-maintain low-speed drive. Specify G-E Gear-motors.

A new stocking plan now makes one-week delivery available on over 300 models. Order your G-E Gear-motor through your nearest G.E. Apparatus Sales Office, or your Authorized G.E. Agent or Distributor. General Electric Co., Schenectady 5, N. Y. 755-11

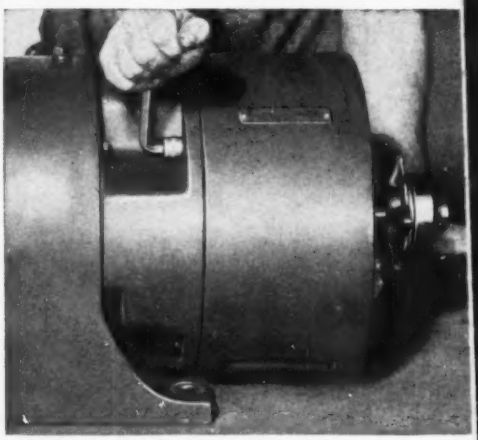
You can put your confidence in—

GENERAL ELECTRIC

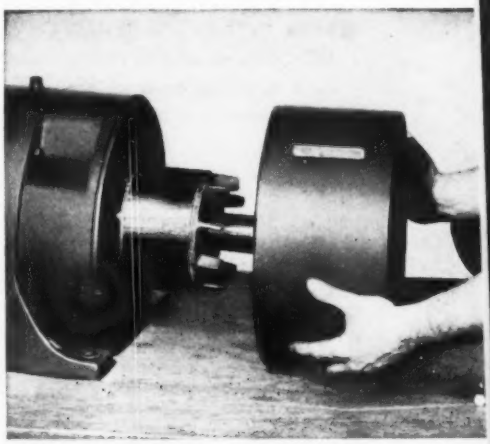
MAINTENANCE IS QUICK AND EASY



REMOVE ENDSHIELD FROM STATOR. If stator removal is required, it's never necessary to remove gear-motor from its foundation or disturb the gear train in any way.



UNBOLT STATOR FRAME BOLTS. Adapter located between motor frame and gear housing gives easy access to stator frame bolts. Note: no special tools are needed.



NOW THE STATOR MAY BE REMOVED. Entire job takes only minutes. This is only one of many features designed to cut "down time" up to 50 per cent.

Fixtures and frames... surface raceways

Control panels... junction and outlet boxes

Bus ducts... bridle rings... switch and cable

Conduit... communication wiring and equipment

Antennae... radar and television installations

Beat down fastening costs, into steel or concrete with super-speed Ramset Jobmaster

FASTENING SYSTEM

Prove for yourself the dollar-and-cents economy and amazing time saving by doing fastening jobs like these, and many others, with RAMSET JOBMASTER and Tru-Set Fasteners. Without any obligation, your local dealer will show you, right on the job, how thousands of RAMSET users have profited, for six years, from the super-speed RAMSET SYSTEM.

Compare JOBMASTER split-second fastening with any other method. See the compact, light-weight, one-piece tool, with fast opening and loading, trigger action and one-hand operation. Watch how Roto-set safety shield, angle fire control and the exclusive Red-Tip Pilot assure perpendicular contact of Tru-Set Fasteners with the work, for straight, firm penetration and highest efficiency.

* SEND FOR "HOW-TO-DO-IT" BOOKLET

Gives detailed suggestions and diagrams for scores of jobs. Tells how to select the best Tru-Set Fastener and power charge. Points out many ways to do your fastening work faster, easier, at lower cost, with RAMSET SYSTEM. Ask your RAMSET dealer for your copy of *Modern Fastening Methods* or write us.

Ramset Fasteners, INC.

Ramset Division, Olin Industries, Inc.

12117 BEREA ROAD • CLEVELAND 11, OHIO

Easy to install...

That's why TRANSITE DUCTS save time, labor and money

THESE "ON THE JOB" photographs show why savings begin right at the start of the installation when you use Transite* Ducts.

The light weight of Transite Conduit and Korduct permits hauling a substantial footage of duct per truck. Handling is fast, too, because the asbestos-cement composition of Transite Ducts makes them strong and tough. The longer length of each duct . . . 10 feet . . . reduces the number of joints in the completed line. And joints are quickly made with the Transite Tapered Coupling that is engineered to stay tight in service.

For the full story of how Transite Ducts can reduce your cableway costs, write Johns-Manville, Box 60, New York 16, New York.

4 OTHER REASONS WHY TRANSITE DUCTS DO A BETTER JOB AT LESS COST:

1. Corrosion-Resistant. Transite, being made of inorganic asbestos and cement, resists corrosion and is immune to electrolysis.

2. Permanently Smooth Bore. Transite makes long cable pulls easy. Danger of damage to cables is also minimized.

3. Incombustible. Transite will not burn nor contribute to formation of smoke, gases, or fumes . . . confines burn-outs and protects adjacent cables permanently.

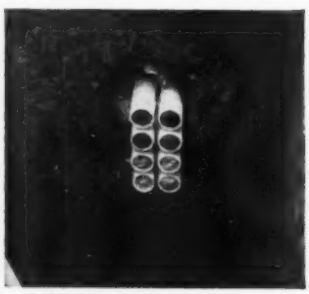
4. Higher Thermal Conductivity. Cables run cooler in Transite, reducing I^2R losses, increasing current capacity and prolonging insulation life.

Easy to Handle: Working in a deep trench, this man finds that the light weight of Transite Ducts helps him work without undue strain.

*Reg. U. S. Pat. Off.

Speeds Installation: Transite Ducts are joined so rapidly that the assembly man can often follow right behind the trencher . . . as shown in this installation.

Speeds Distribution: The light weight of Transite Conduit enables the contractor to haul a large number of ducts per truck and speed distribution on job site.



Cuts Manhole Costs: Concrete will be poured directly around these Transite Ducts to form the manhole wall, a time and material saving made possible by Transite's strength.

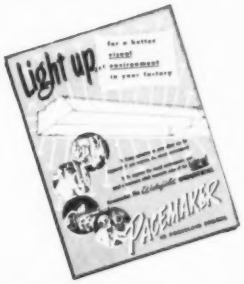
Johns-Manville TRANSITE DUCTS

JOHNS-MANVILLE JM PRODUCTS

TRANSITE KORDUCT—for installation in concrete

TRANSITE CONDUIT—for exposed work and installation underground without a concrete encasement

Here's an industrial luminaire that has nearly everything



Would you like an illustrated 4-page folder? Just write to The F. W. Wakefield Brass Company, Vermilion, Ohio.

It has a light distribution of about 25% up and 75% down. That's basic for comfortable seeing. Offices have been away ahead of factories on this score.

It has all major reflecting surfaces finished in porcelain enamel. That means long life, easy cleaning, no discoloring.

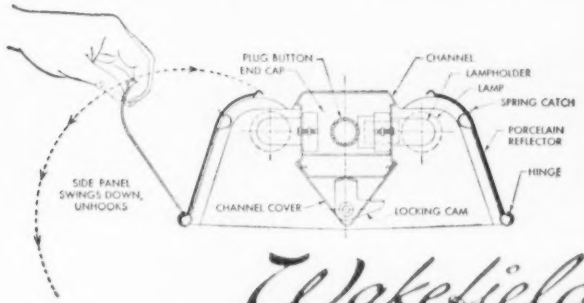
It has side panels that unhook and hinge downward. That means easy, quick, safe cleaning. As for lamps, you can replace them *without* unhinging the side panels.

It has channels, channel covers, end panels and side panels of heavy gauge steel. Really rugged.

It has ETL approved, brick type ballasts that deliver full rated lamp watts. Very good feature. Means fewer luminaires per square foot.

It has a simple chain suspension that permits hanging at almost any distance below the ceiling. Singly or in continuous runs.

It has been designed to use either pre-heat Rapid Start (40W) or Slimline lamps. Take your choice in 4', 5' or 8' lengths.



Now do you see why we say the Pacemaker has nearly everything? To be honest, we think it does have everything a modern industrial luminaire ought to have, but a little understatement never hurts. At that, there is one thing it doesn't have. It doesn't have a sky-high price tag.

Wakefield Over-ALL Lighting

"Cut costs with Buckeye Conduit-- it bends so uniformly!"

MIDWEST CONTRACTOR TALKS ABOUT CONDUIT: "When I pay good money for workers, I want the utmost in production. That's why I use Youngstown "Buckeye" conduit. My men bend and install "Buckeye" in short order without wasting precious time."

ELECTRICAL WHOLESALER DESCRIBES BUCKEYE CONDUIT: "My customers tell me that bending "Buckeye" evenly takes a minimum of time and effort. This enables them to cut down on overtime work. As far as I'm concerned, I recommend "Buckeye" highly."

Youngstown makes rigid steel conduit from start to finish. This enables Youngstown to control the complete manufacturing process which insures that each length of "Buckeye" Conduit is made of topgrade steel. Since only high quality steel makes for easy bending, it's no wonder Youngstown "Buckeye" conduit is favored by electrical men.

Shipments of "Buckeye" rigid steel conduit are now being made from our conduit mills at Indiana Harbor and Youngstown.

QUALITY YOUNGSTOWN SERVICE

THE YOUNGSTOWN SHEET AND TUBE COMPANY

General Offices — Youngstown 1, Ohio

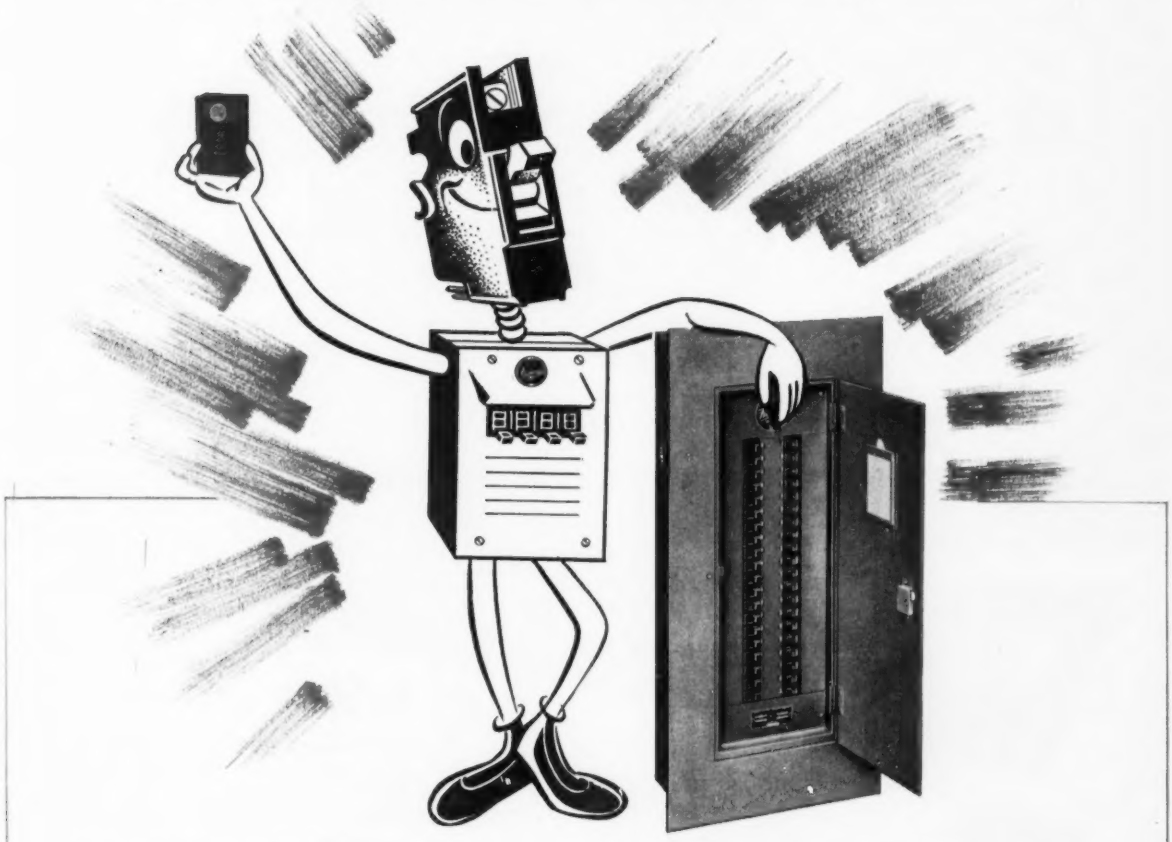
Manufacturers of Carbon, Alloy and Yoloy Steel

Export Office - 500 Fifth Avenue, New York

COLD FINISHED CARBON AND ALLOY BARS - ELECTROLYTIC TIN PLATE - COKE TIN PLATE - WIRE - PIPE AND TUBULAR PRODUCTS - CONDUIT - RODS - SHEETS - PLATES - BARS - RAILROAD TRACK SPIKES.

WE DARE YOU!

Just try to stump the Stab-lok® System with any logical combination of circuit breaker requirements



ONE CIRCUIT or 20 circuits... add range and hot water heater! You can't find a sensible specification for circuit breaker protection that the sequence bussed Stab-lok can't meet with ease, speed and economy!

Electric radiant heating? Stab-lok LA2600 takes that in stride. A 42-circuit panelboard? You can assemble it in minutes, from your distributor's stock. Single phase or 3 phase, 4 wire? Stab-lok gives you a real choice.

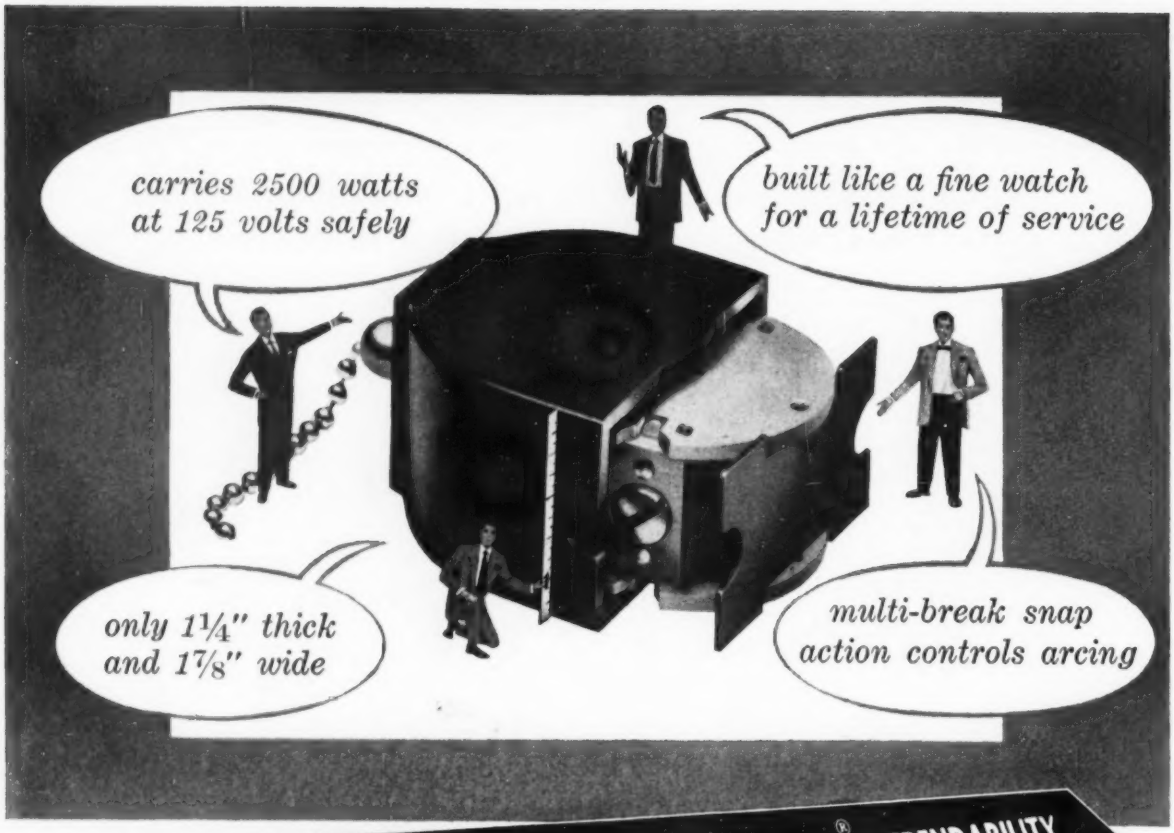
Stab-lok's *complete* range of enclosures meets all needs, even for special applications. With 3MBA, for instance, you can convert a multi-breaker into a Stab-lok in next to no time. Most enclosures are the Noark flush-surface type and practically cut your stock requirements in half.

Last, but not least, the Stab-lok system slashes installation costs. Enclosures have ample wiring space... backplate is removable for wire pulling ...all components are accessible. Write for the whole Stab-lok story...and order Stab-loks from your distributor today.

Federal Electric Products Company, 50 Paris St., Newark 5, N. J.

Federal Noark products: Stab-lok Circuit Breakers, Motor Controls, Safety Switches, Service Equipment, Industrial Circuit Breakers, Panelboards, Switchboards, Control Centers, Bus Duct ★ Sales offices in principal cities.

FEDERAL NOARK®


carries 2500 watts at 125 volts safely
built like a fine watch for a lifetime of service
only 1¼" thick and 1⅞" wide
multi-break snap action controls arcing

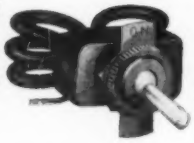
NEW 20 AMP SWITCH HAS Levolier® DEPENDABILITY

Levolier® model 2020

Proven dependability of Levolier Switches is now available in 20 amps 125 volts. The new No. 2020 is expressly designed to control 2500 watts safely on heaters, motors, high bay lighting, fluorescent banks, etc. Single pole multiple break mechanism with AC and DC rating. Brown molded phenolic case easily removed for wiring. Smallest 20 amp pull chain switch made — only 1¼" thick. Underwriters' Laboratory inspected.

Model 41
6 Amp "T" 125V.

Model 1010
10A "T" 125V.



Model 25
6A "T" 125V. Colored plastic levers

Model 4100
Industrial socket 660 Watt 250V.

Model 71
6A "T" 125V

all are McGILL® quality

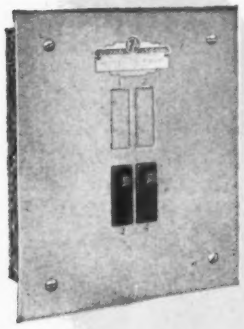
Send for the new McGill catalog No. 49-A describing the complete line of McGill Lamp Guards, Sockets and Switches.

McGILL®
electrical specialties

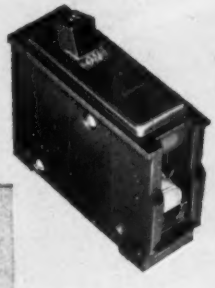
McGILL MANUFACTURING COMPANY, INC. 450 N. Campbell St., Valparaiso, Indiana

THEY'RE TOPS IN CIRCUIT PROTECTION

QP QUICKLAG P { add-on type } LOAD CENTERS and SERVICE EQUIPMENT



QP QUICKLAG P SERVICE EQUIPMENT



QP QUICKLAG P CIRCUIT BREAKER

QP QUICKLAG P LOAD CENTER

They are ideal for homes, offices, stores and other commercial buildings, schools, hotels and institutions of all kinds — where safe, dependable, automatic circuit protection is desired.

Shockproof and easy to operate, these assemblies have the added advantage of providing adequately for today's electrical requirements, and by virtue of the add-on feature, make the addition of new circuits or changes in capacities a matter of simply adding new units.

Featured is the new FA type QP Quicklag P Circuit Breaker, which provides quick make and quick break operation either manually or automatically. On harmless overloads the thermal-trip feature automatically trips the circuit breaker with the handle position indicating the circuit in trouble. On severe overload or short circuit the magnetic trip speeds the opening of the circuit breaker. Once the cause of the difficulty is removed, service is restored by simply moving the handle to the "off" position and then to "on".

Screwless assembly (*just slip the breakers in*), one pressure type of connection between circuit breaker and bus bar, and "sequence bussing" to balance the load and permit double pole, individual trip combinations, are other features.

Four basic combinations (*see chart*) in four sizes of enclosures, plus a stock of individually packaged single pole and double pole FA QP Quicklag P Circuit Breakers will fit almost any job requirement. Because all add-on circuit breakers are interchangeable, it is as easy as replacing a light bulb to make changes. Main Circuit Breakers also available in slightly larger enclosures.

The next time you have a job requiring load centers and service equipment, install FA QP Quicklag P units. Your clients will be glad you did. For additional information consult your nearest FA representative listed in Sweet's.

USE THIS CHART IN CHOOSING THE RIGHT FA QP QUICKLAG P LOAD CENTER AND SERVICE EQUIPMENT

Maximum Feeder Capacity — Main Lugs	Maximum Number of Poles	BOX SIZE
70 amp.	2-4	7½ x 9 x 3½
70 amp.	6-12	9 x 13 x 3½
100 amp.	6-12	9 x 16 x 3⅝
100 amp.	14-20	9 x 20 x 3⅝

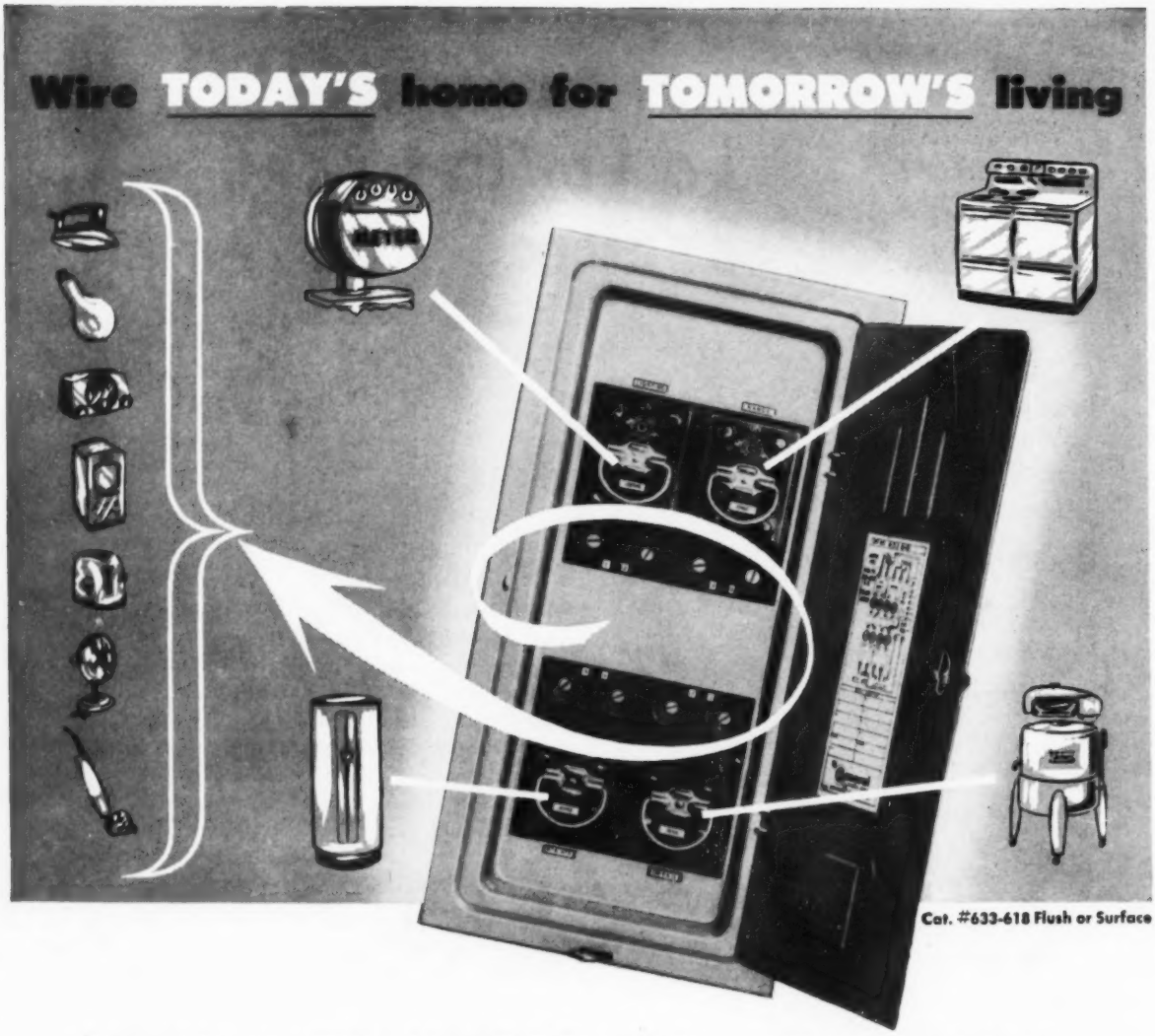
NOTE: Basic unit includes 50% of maximum number of circuits that can be installed in each enclosure. Complete factory assemblies also available.

Frank Adam Electric Co.

P. O. BOX 357 . ST. LOUIS 3, MISSOURI

Makers of: BUSDUCT • PANELBOARDS • SWITCHBOARDS • SERVICE EQUIPMENT • SAFETY SWITCHES • LOAD CENTERS • QUIKHETER

Wire TODAY'S home for TOMORROW'S living



Cat. #633-618 Flush or Surface

General brings you a "Main and Range Plus"! The *quadruple* pullout unit that actually plans for the future. Not only does this all-in-one unit take care of today's wiring requirements . . . it *anticipates* tomorrow's needs. Eliminates costly auxiliary wiring equipment, and unsightly additions. The General Quadruple Pullout unit is neat, compact, thoroughly dependable. It saves you time and materials . . . at a price you want to pay. No wonder wholesalers and contractors all over the country are saying: Switch to General today! Available everywhere exclusively through wholesalers.

100 Amp. main lugs feed 4 pullouts connected in parallel. One 60 Amp. functions as a main disconnect for eight 30 Amp. plug-fuse branch circuits and the 60 Amp. sub-feed lugs. Three additional pullouts (one 60 Amp. and two 30 Amp.) control appliances such as, Ranges, Water Heaters, Dryers, etc. Other combinations may be ordered.

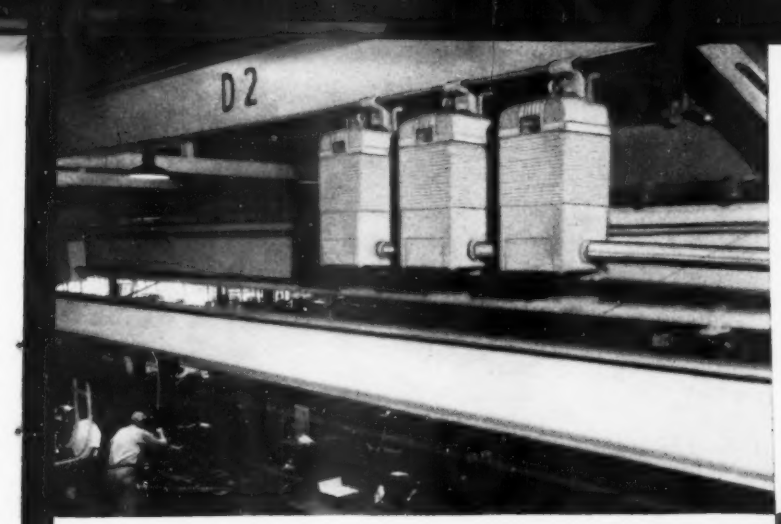
Sales Offices in every Major City

General Switch Corp.

Write for catalog #5201

45 ROEBLING ST. • BROOKLYN 11, N. Y.

ENCLOSED SAFETY SWITCHES • SERVICE ENTRANCE EQUIPMENT • BRANCH CIRCUIT PANELS



METAL-WORKING INDUSTRY stretches power dollars by stepping down voltage at the load. At left, Type M Transformers in tool room of DeLaval Steam Turbine Co., Trenton, N. J., convert 480 volts to 240 volts for machine tools.

TEXTILE INDUSTRY saves with G-E Dry-types like these Type D's used at Albany Felt Co., Albany, N. Y., to step down voltage for plant lighting (below). Type D's, for indoor use, are rated 25 kva and above. Indoor and outdoor loads can use Type M's (.25 through 15 kva).

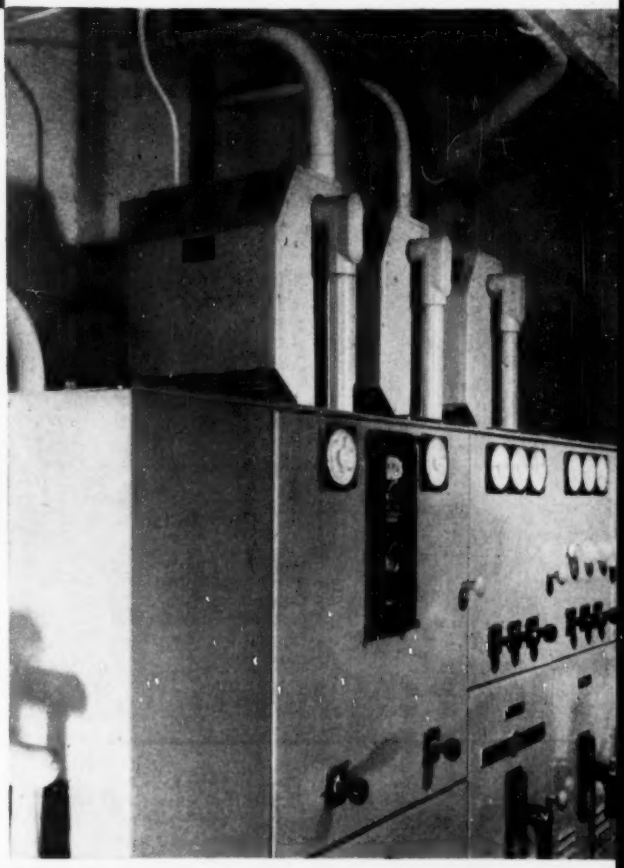
How 3 plants save with G-E Dry-type Transformers

By supplying correct voltage where it is needed—at the load—G-E Dry-type Transformers help stretch power dollars. That's because they eliminate long runs of secondary feeders, cut line losses, reduce wiring costs. Easily installed on columns, wall brackets or platforms, G-E Dry-type Transformers cut costs on both installation and maintenance. Designed for efficient cooling, they require virtually no inspection.

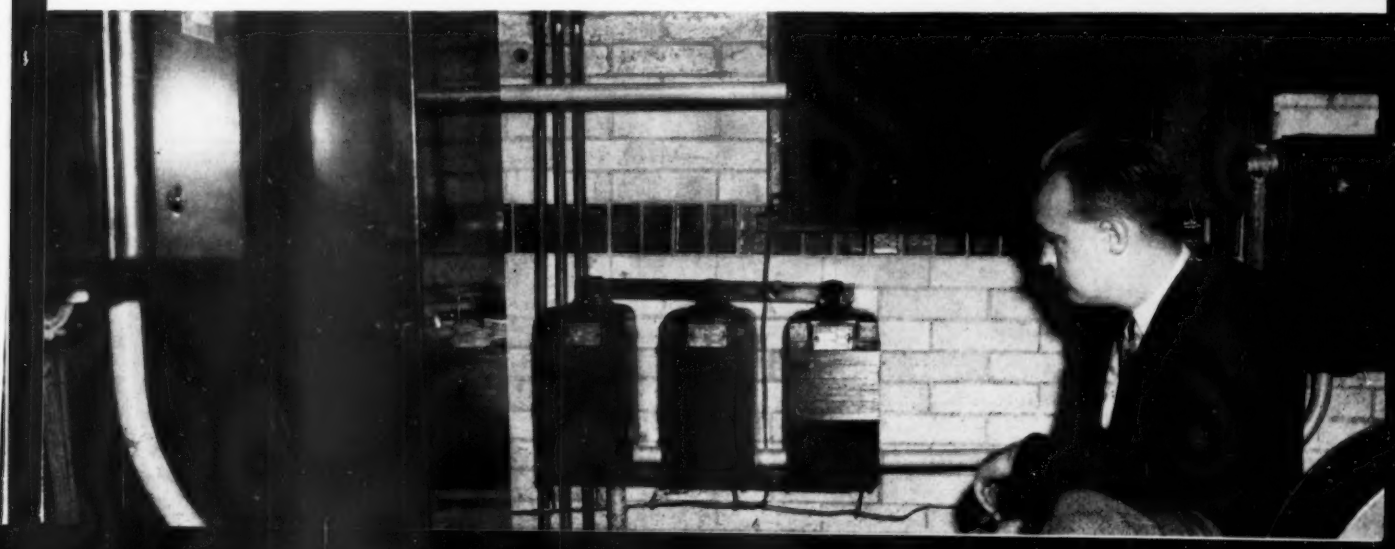
For information on how G-E Dry-type Transformers can reduce your power losses, call your nearest authorized G-E Distributor. Or write for Bulletin GEC-868A, to Section 411-109, General Electric Company, Schenectady 5, N. Y.

You can put your confidence in—

GENERAL ELECTRIC

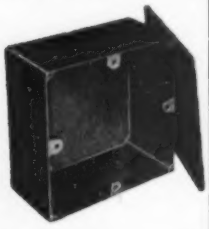


UTILITY uses G-E Type M Transformers to step down 480 volts for lighting and control circuits. These (below) are installed at the Washington Suburban Sanitary Commission, Hyattsville, Maryland.



O. Z. cast iron boxes

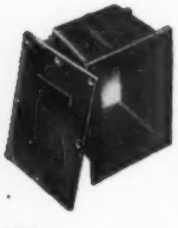
COMPLETE LINE • COMPLETE LINE • COMPLETE LINE **COMPLETE LINE**



TYPE YS
Unflanged junction box with cover. Flush or Surface mounting.

TYPE YW
Weatherproof pull box. Complete with one-piece rubber gasket and hinged cover; surface mounting.

TYPE YE
Explosive resisting junction box designed in accordance with Underwriter's Laboratory requirements. Cover and flange are accurately machined and correct bolt spacing provided. Flush or Surface mounting.



TYPE YF
Flanged watertight box with cover complete with rubber gasket. Flush or Surface mounting.

3214

When you specify O. Z. Cast Iron Boxes for industrial, railroad, airport, oil refinery and other heavy-load circuits, you specify the best. Cast from close-grained, grey iron, these sturdily constructed boxes are accurately machined to your requirements and then hot-dip galvanized to provide maximum corrosion resistance.

No matter what the operating condition . . . explosion resisting, watertight or weatherproof . . . you'll find a box to fit the job in O. Z.'s complete line. All boxes can be supplied with or without bosses or mounting lugs and are drilled for conduit entrances as required.

For detailed information on O. Z.'s Cast Iron Boxes as well as 150 other electrical fittings, write for our catalog.

- CAST IRON BOXES
- SOLDERLESS CONNECTORS
- CONDUIT FITTINGS
- CABLE TERMINATORS
- GROUNDING DEVICES
- POWER CONNECTORS

Buy O. Z. and you'll see why Engineers say,

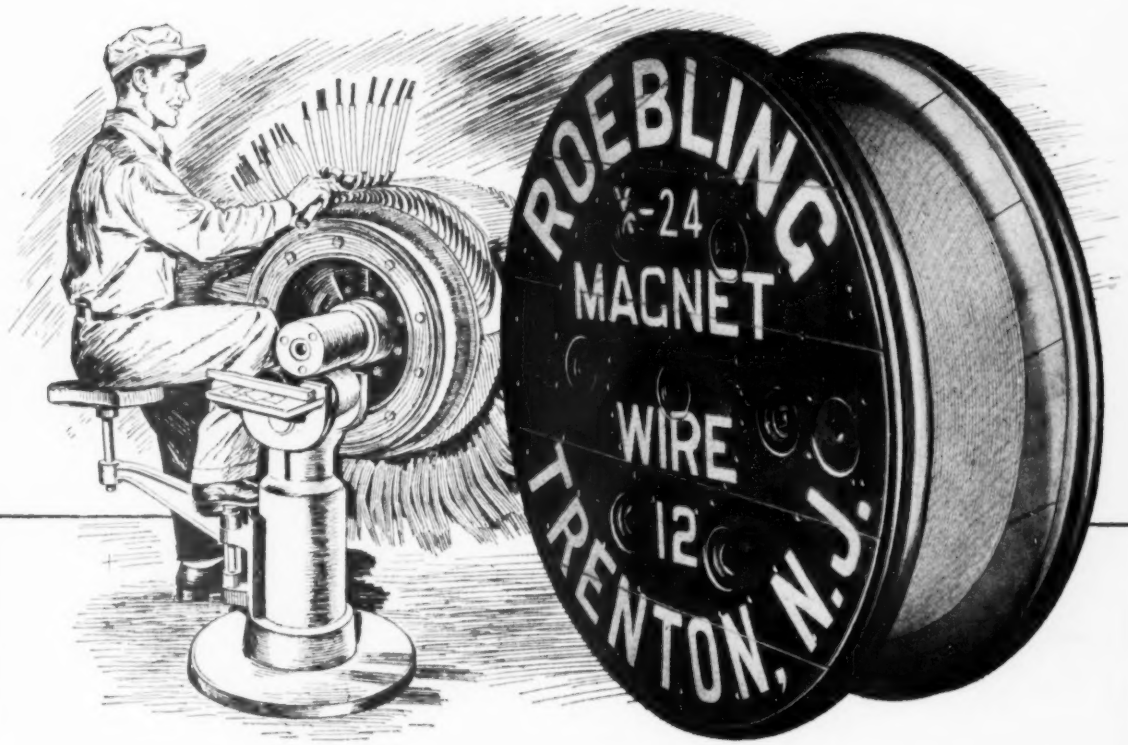
"They're OK If They're O. Z."

O. Z. ELECTRICAL MANUFACTURING COMPANY, INC.

262 BOND STREET · BROOKLYN 2, N. Y.

Now...a new high temperature magnet wire...

ROEBLING ROETEMP



ROETEMP MAGNET WIRE brings you a brand new and superior type of insulation for applications that involve high operating temperatures. Its heat-resistant properties and dielectric strength, its extra toughness and working ease make this new Roebling ROETEMP your top choice for Class B transformer windings and for other electro-magnet devices that operate up to 105°C., with a hot spot temperature of 125°C.

Roebling ROETEMP Magnet Wire is insulated with a specially processed tape applied in a single wrap with a liberal overlap. It is exceptionally pliable and bends without cracking or separating from the conductor. It won't unravel; is ideal for higher speed winding; comes in a range of sizes from #1 to #12 AWG, round, square and rectangular.

Write for data on Roebling ROETEMP Magnet Wire... and Roebling silicone bonded ROEGLAS wires for special temperature problems. John A. Roebling's Sons Corp., Trenton 2, N. J.

A subsidiary of The Colorado Fuel and Iron Corporation

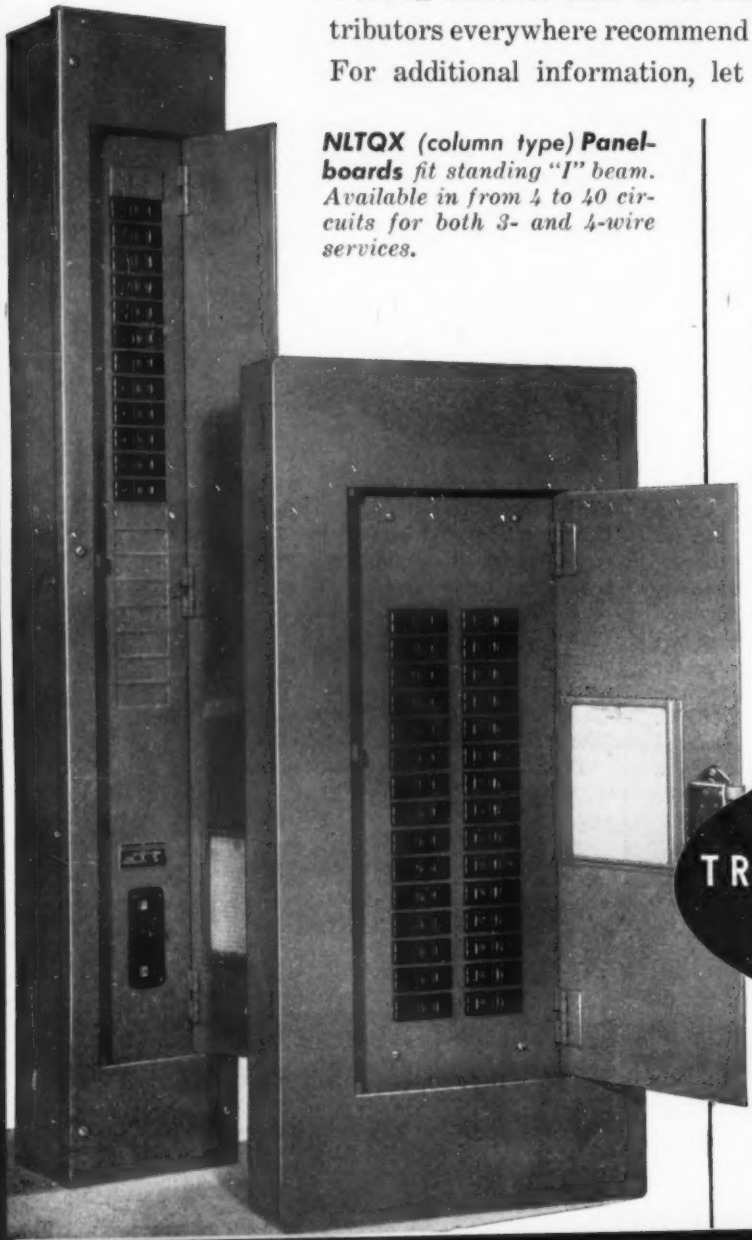
ROEBLING

ATLANTA, 934 AVON AVE • BOSTON, 51 SLEEPER ST & 5 PITTSBURGH ST • CHICAGO, 5525 W. ROOSEVELT RD • CINCINNATI, 3253 FREDONIA AVE • CLEVELAND, 13225 LAKEWOOD HEIGHTS BLVD. • DENVER, 4801 JACKSON ST • DETROIT, 915 FISHER BLDG • HOUSTON, 6216 NAVIGATION BLVD • LOS ANGELES, 5340 E. HARBOR ST & 120 S. HEWITT ST • NEW YORK, 19 RECTOR ST • ODESSA, TEXAS, 1920 E. 2ND ST • PHILADELPHIA, 230 VINE ST • PITTSBURGH, 1301 CLARK BLDG • ROCHESTER, 1 FLINT ST • SAN FRANCISCO, 1740 17TH ST • SEATTLE, 900 1ST AVE S. • ST. LOUIS, 3001 DELMAR BLVD • TULSA, 321 N. CHEYENNE ST • EXPORT SALES OFFICE, TRENTON 2, NEW JERSEY

PICK TRUMBULL NLTQ LIGHTING PANELBOARDS

..for more convenience in less space with maximum protection and flexibility for future needs

Trumbull's fifty-year leadership in panelboards has never been more in evidence than in its NLTQ line. Leading electrical distributors everywhere recommend them and carry complete stocks. For additional information, let us mail you Bulletin TEB-14.



***NLTQX** (column type) **Panelboards** fit standing "I" beam. Available in from 4 to 40 circuits for both 3- and 4-wire services.*

3 WAYS BETTER...

1. Circuit breaker convenience and protection. Type TQL. Quick-make, quick-break. Thermal-magnetic trip, arc-quenching design and trip-free action for top protection. Convenient plug-in design and manual re-set. Equally important, it has a separate trip indicating position.

2. Strong compact interiors readily removable for fast installation. Busbars molded in plastisol, and braced against damage from current surges. Run cooler than in open air.

3. Compact boxes, protected fronts. Adequate knockouts and gutters. Front integral with barrier. Breaker knockouts in front panel to provide for future circuits.

TRUMBULL (T) ELECTRIC

DEPARTMENT OF GENERAL ELECTRIC COMPANY
PLAINVILLE, CONN.

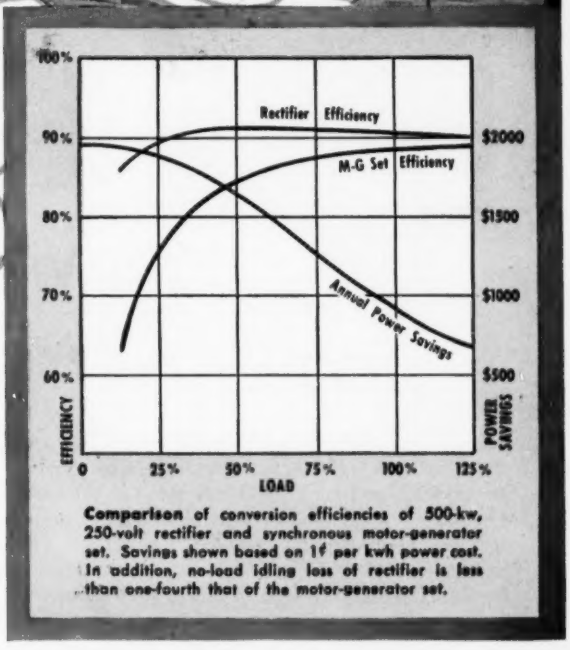
***NLTQ Panelboards** available in from 4 to 42 circuits for both 3-wire and 4-wire services with lugs only or Trumbull 50 to 225 ampere breakers in the mains, and TQL 120 volt, 10 to 50 ampere circuit breakers on branches. AC only. Underwriters' Laboratories, Inc. listed.*

HERE'S PROOF of Low-Loss Conversion

TO OBTAIN economical dc power for arc furnace and blooming mill auxiliaries, West Virginia Steel & Manufacturing Company recently installed mercury arc rectifiers.

The factory-packaged Allis-Chalmers unit includes duplicate 500-kw, 250-volt rectifiers, with tube, breaker, control, and metering compartments, plus dc and ac plant feeder breakers. Since transformers could be installed outdoors, the assembly departs from the usual double-ended arrangement.

Rectifiers were chosen for their high conversion efficiencies *plus* simplified foundation needs, easy installation and minimum maintenance. And Allis-Chalmers units incorporate continuous excitation, grid phase control, internal cooling and enameled anode seals.



Comparison of conversion efficiencies of 500-kw, 250-volt rectifier and synchronous motor-generator set. Savings shown based on 1¢ per kwh power cost. In addition, no-load idling loss of rectifier is less than one-fourth that of the motor-generator set.

Use A-C's Engineering Experience

By calling your A-C representative, you can put A-C's quarter century of rectifier application experience to work on your power conversion problems. Allis-Chalmers, Milwaukee 1, Wisconsin. A-3989

ALLIS-CHALMERS

Our Engineers Introduced Mercury Arc Rectifiers to U. S. Industry

"With Westinghouse transformers we don't worry about costly shutdowns!"

A heat-treating furnace located in a crowded production area at Marlin-Rockwell Co. needed economical and reliable power close to the load. Mr. Merville Pineo, Engineer in charge of maintenance, made this statement—

"Any transformer failure would be extremely costly to us, inasmuch as it would shut down the furnace. We've had no power breakdown with Westinghouse transformers. I have a high regard for Westinghouse transformers because of their dependability and minimum of maintenance requirements. During routine checkups, we've found they're easy to get into . . . and you'll never find a maintenance engineer who will complain about that!"

On-the-spot power was possible with Westinghouse dry-type transformers because they are small and light enough to be mounted on an overhead platform. Long, high-cost secondary runs are eliminated—valuable floor space saved.

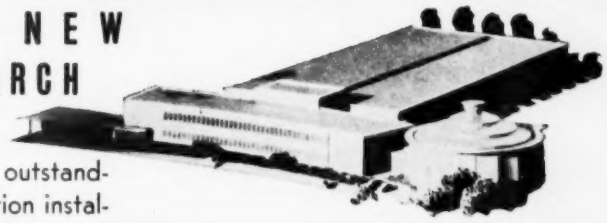
Westinghouse dry-type transformers may solve a problem of yours—at impressive savings in installation and maintenance. Call in your Westinghouse representative—he'll be glad to talk with you. Or write for booklet B-5812, Westinghouse Electric Corporation, P. O. Box 868, Pittsburgh 30, Pennsylvania. J-70667

YOU CAN BE SURE... IF IT'S

Westinghouse

CONGRATULATIONS to FORD

ON THE BEAUTIFUL NEW ENGINEERING AND RESEARCH CENTER AT DEARBORN



Among the notable architectural features in this outstanding new building is the Smithcraft Area Illumination installation of overall lighting.

LOOKING OVER INSTALLATION IN DRAFTING AREA ARE PINGREE CONFLETTI, HARLAN ELECTRIC COMPANY SUPERINTENDENT AND J. S. ECCLESTONE, SMITHCRAFT REPRESENTATIVE.

. . . AND CONGRATULATIONS TO THE HARLAN ELECTRIC COMPANY OF DETROIT, ELECTRICAL CONTRACTORS

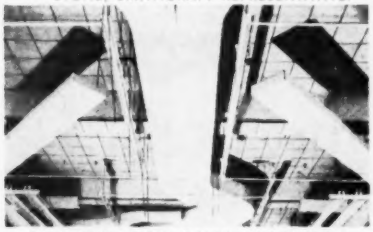
According to C. Allen Harlan: "Smithcraft Area Illumination has obviously been designed with the needs and problems of the electrical contractor in mind. It is almost unbelievably easy and efficient equipment to install". There's a real satisfaction in installing a Smithcraft Area Illumination system . . . satisfaction in the way the job goes together . . . satisfaction in the finished appearance . . . and satisfaction in excellent profits for a superior lighting job well done. One good installation leads to another . . . and to more and more sales. Smithcraft Area Illumination is **that good** both in its clean, trim, modern appearance and in its glare-free, low-bright illumination.

● ● ●

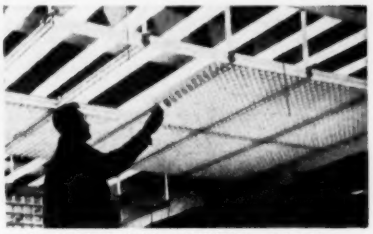
Once the hangers are in position on the ceiling, all you need is a level and a screwdriver. Everything goes in place quickly and easily with no careful dimensioning or critical locating of parts. Even the hangers are positioned almost haphazardly with an adjustment of 2" built right into the hangers. There's plenty of margin for error or for walls and ceilings that are not absolutely true.

● ● ●

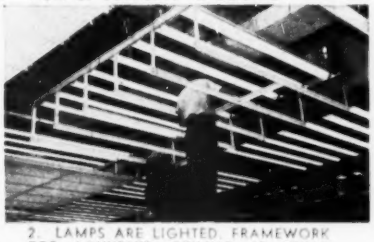
If you don't know about Smithcraft Area Illumination, investigate now. We'll be glad to send further information and any of the Smithcraft representatives throughout the country will be glad to tell you about it.



1. INSTALLATION COVERS NETWORK OF BEAMS AND DUCTS WITH MINIMUM OF SUPPORTS TO CEILING.



3. INSTALLING LOUVERS. GLASS, PLASTIC, LENS . . . VIRTUALLY ANY SHIELDING MEDIUM CAN BE USED.



2. LAMPS ARE LIGHTED. FRAMEWORK FOR LOUVERED CEILING IS BEING INSTALLED.

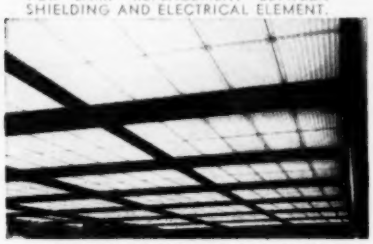
4. PLENTY OF UNOBSTRUCTED SPACE FOR LAMP REPLACEMENT BETWEEN SHIELDING AND ELECTRICAL ELEMENT.

There are three separate installations of Smithcraft Area Illumination in the Ford Engineering and Research Center with a combined area of more than 65,000 sq. ft. Intensities in the three areas are 112 footcandles, 100 footcandles and 108 footcandles.

Architects: Voorhees, Walker, Foley and Smith, New York

Electrical Contractors: Harlan Electric Company, Detroit

Distributors: General Electric Supply Company, Detroit



5. INSTALLATION CONFORMS TO CONTOUR OF BUILDING. ACOUSTICAL TREATMENT IS SUPPORTED ENTIRELY BY LIGHTING SYSTEM.

Smithcraft

LIGHTING DIVISION, CHELSEA 50, MASS.

GET ON THE BEAM

For building lighting business

enter the lighting competition for electrical contractors...

. . . with one or more of the following types of lighting installations: Stores, Schools & Offices, Industrials, Residential, Floodlighting, Miscellaneous (hospitals, banks, lobbies, etc.)

- ★ $1050 in cash awards
- ★ Publication of winning entries
- ★ Free reprints of published articles for local sales promotion

The Competition closes on August 1st

Lighting Competition Chairman
ELECTRICAL CONSTRUCTION AND MAINTENANCE
330 West 42nd Street, New York 36, N. Y.

I'm not going to miss the boat. Send me the Rules Brochure and _____ Entry Forms.

NAME _____

COMPANY _____

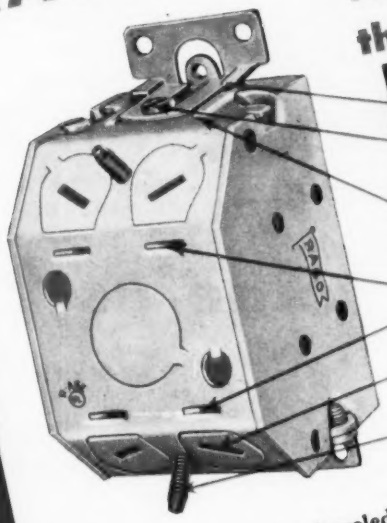
ADDRESS _____

CITY _____ ZONE _____ STATE _____

ELECTRICAL CONSTRUCTION AND MAINTENANCE
A McGRAW-HILL PUBLICATION
330 WEST 42nd STREET, NEW YORK 36, N. Y.

RACO'S BLOS...

the one-screw box that's 6 ways better!



1. The heavy embossed shoulder on the plaster ear insures greater strength.
2. Slot and position of screw allow maximum adjustment — 0" to ¾".
3. Long, deep embosses on body hold ear rigid and provide a perfect channel.
4. Cable rests on these smooth embossments, securely held, well protected.
5. Insert screwdriver in these angled slots and one natural twist removes KO.
6. Clamp screws emerge from beveled side so box can be mounted on a flat surface.

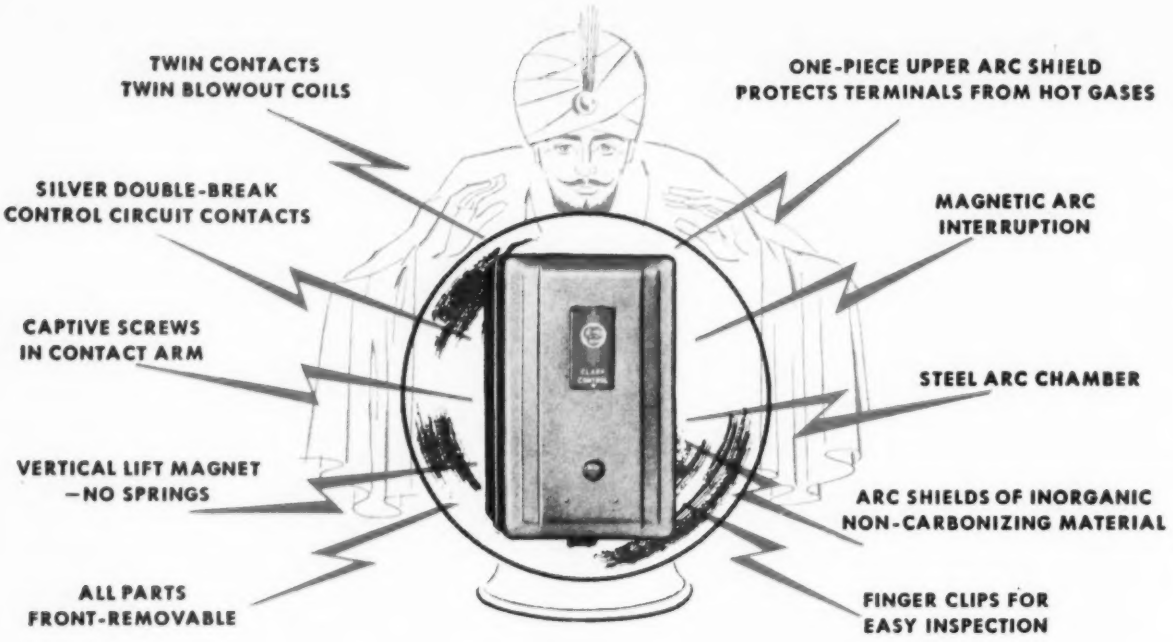
This RACO one-screw, beveled loom box provides the answer to the electrician's need for a one-screw box that has a plaster ear with the strength to hold permanently, that can be guided evenly into place, and has up to ¾" of adjustment. What's more, the clamp screw emerges on the beveled side of the BLOS and allows it to be mounted on a flat surface. Here's another example of why RACO leads the field... from coast to coast.

You can always rely on RACO

RACO

ALL-STEEL EQUIPMENT Inc.—800 Kensington Ave., Aurora, Illinois

"A BOX FOR EVERY NEED"



You don't have to be "psychic" to see CLARK TYPE "CY" superiority

CLARK TYPE "CY" **STARTERS** have everything—everything, that is, to make installation, wiring, inspection, and maintenance easy.

CLARK TYPE "CY" **STARTERS** can be inspected and maintained with only two tools—a wrench and a screw driver.

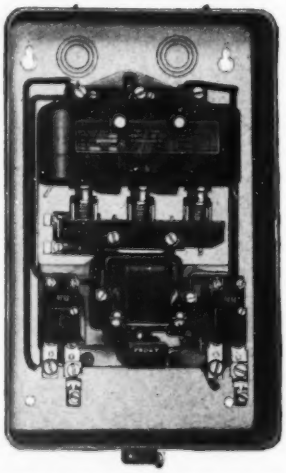
CLARK TYPE "CY" **STARTERS** have concentric knockouts—top—bottom—and sides—ample wiring space, are front connected and all parts are front removable.

CLARK TYPE "CY" **STARTERS** have spare part kits for all sizes 0-1-2-3.

CLARK TYPE "CY" **STARTERS** employ a new and different principle of arc quenching which lengthens contact life.

CLARK TYPE "CY" **STARTERS** are available in NEMA enclosures to meet all industrial applications.

CLARK TYPE "CY" **STARTERS** give user satisfaction—which means that the installing contractor will be called back for future installations.



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Washington Report

Eisenhower's policies are firming, are being more clearly defined. He wants Federal spending trimmed in all directions, short of endangering national security, has asked that tax relief be postponed until January 1, 1954, in effort to balance the budget during fiscal 1955. He is putting emphasis on military production now and over the next couple of years, rather than on continued buildup of capacity for future output. These spending cuts result in increased military and economic strength at an earlier date.

Proposed Administration tax program calls for 1) extension of excess profits tax without modification for six months to December 31, 1953; 2) rescind corporate income tax scheduled reduction from 52% to 47%, effective April 1, 1954; 3) reduce individual income taxes January 1, 1954 as scheduled; 4) rescind scheduled reductions on excise taxes effective April 1, 1954; 5) postpone scheduled increase of ½% on both employers and employees on old age insurance taxes for one year; and development of program for major revisions in whole tax structure with recommendations to Congress by January.

Business activity remains at a high level, with few signs of an early letdown. Commerce Dept. reports inventories at end of March up $1.4-billion over a year ago, at $75-billion. Demand for electric power continues at record levels—nearly 8-billion kwhr per week, or about 12% over a year ago. Steel production has been at rate of slightly over 2¼-million tons a week—a shade over 100% capacity. Record for first four months was 38,543,800 tons, or 10% above year ago.

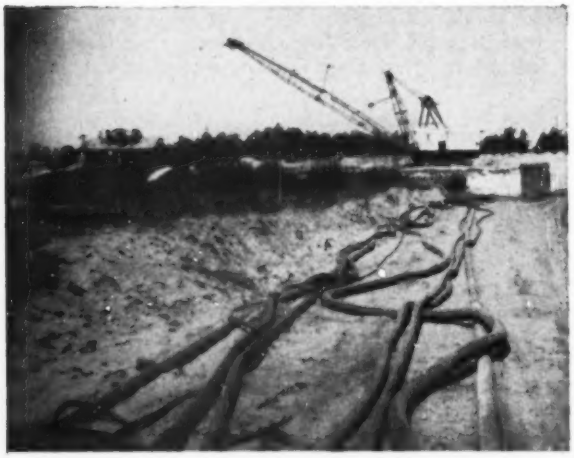
Non-farm employment is leveling off at about 48,800,000, or 1,300,000 over a year ago. Factory job total is 17,050,000, or slightly more than 1-million over a year ago. Federal Government employment is down 60,000 from this period last year, at about 2,300,000.

A new pattern for preparedness is the responsibility of the new Office of Defense Mobilization created by Eisenhower, which automatically becomes legal in mid-June unless Congress votes it down. It pulls all emergency planning under one agency, with two main functions: plan for both full and partial mobilization, and serve as the nucleus around which actual controls agencies can be swiftly built when needed. Director of this new agency will be on a par with Cabinet members.

The new ODM, which will if approved be a permanent agency, will assume the functions of the old National Security Resources Board and the stockpile responsibility of the old Munitions Board, both now abolished. Plans also call for six major offices, each headed by an assistant director, as follows: Production and requirements, materials, financial policy, non-military defense, manpower and economic stabilization. In addition, these old ODM advisory committees would be retained: Defense Mobilization Board, National Advisory Board on Mobilization Policy, Labor-Management Manpower Policy Committee, Health Advisory Committee, and Science Advisory Committee.

Atomic power plants are feasible, could be completed in three to five years if begun immediately. That is one of several conclusions reached in four separate technical reports, parts of which AEC has released recently. These reports were completed last October by four pairs of industrial firms, working as teams, on the feasibility of producing electric power from atomic energy. All four groups also proposed to harness heat produced in a controlled atomic reaction, which would be used to generate steam to drive orthodox turbines and generators.

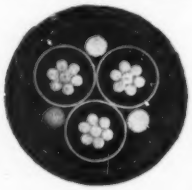
Underwater operation holds no peril for these Hazacord cables. Skid mounted junction box contains four 400 amp. circuit breakers . . . single cable leads from transformer bank; four branch circuits go to the control house near the shovel (below). The 500 horsepower motor which operates the pit-pump used for pumping the phosphate-bearing matrix to the washer also gets its power through Hazacords.



Grabbing 17 yards of phosphate rock in a single bite, this enormous dragline supplies raw material for fertilizers and chemicals produced by the Virginia-Carolina Chemical Corporation. Power is furnished by thousands of feet of Type SH-D, 5000-volt Hazacord cable.

Hazard's exclusive ZBF sheath—cured under pressure in a continuous metal mold—is one reason why Hazacord cable can take the rough treatment it gets being dragged over this rugged Florida terrain.

V-C CHEMICALS SELECTS LONG-LIVED HAZACORD SHOVEL CABLES FOR RUGGED PHOSPHATE MINING OPERATION



Hazacord Type SH-D was used exclusively by V-C for this important mining job. The safest and most widely used type for high-voltage work, Hazacord Type SH-D has copper shielding braid over each insulated conductor . . . grounding conductors in the interstices. For use up to 15000 volts.

On *every* job . . . from a giant dragline to a portable electric saw, Hazacords are setting new standards for long, economical service from cords and cables. Get complete information from your Hazard representative, your jobber or write to us today. Hazard Insulated Wire Works, Division of The Okonite Company, Wilkes-Barre, Pennsylvania.

HAZARD HAZACORD *Mold-Cured* portable cables

1403

JUNE . . . . at a Glance

Contents Pages

Growth, being a gradual process, is usually observed only in crisis, like the fit of Junior's school shoes on the first morning after vacation. While we have observed the growing list of articles each month in these pages, we hardly noticed the change until suddenly we outgrew our Contents Page. The crisis, as such crises have a way of doing, landed in the capable hands of Art Director Hi Phillips. After reviewing hopelessly the chances of shrinking the editorial output to fit the page, he came forth with a two-page layout that should give us more room to grow in (pages 3 and 4).

New Standards

The Ford Motor Co. is currently celebrating its golden anniversary. It is especially appropriate that the opening of the new Styling Building, one of a series of new buildings at the Ford Research and Engineering Center, should come at the same time. The anniversary invites us to look back on a distinguished record of industrial accomplishment. The Styling Building, in its electrical features particularly, gives us a compelling appraisal of the future. Conventional contemporary lighting design has been left far behind in a bold application of modern lighting technology which may be setting our future industry's standards. From louvered panel ceilings, cover and recessed units, lighting intensities ranging up to 200 footcandles are employed under precise control. The building is the subject for our "Outstanding Electrical Construction" feature this month beginning on page 65.

Industrial TV

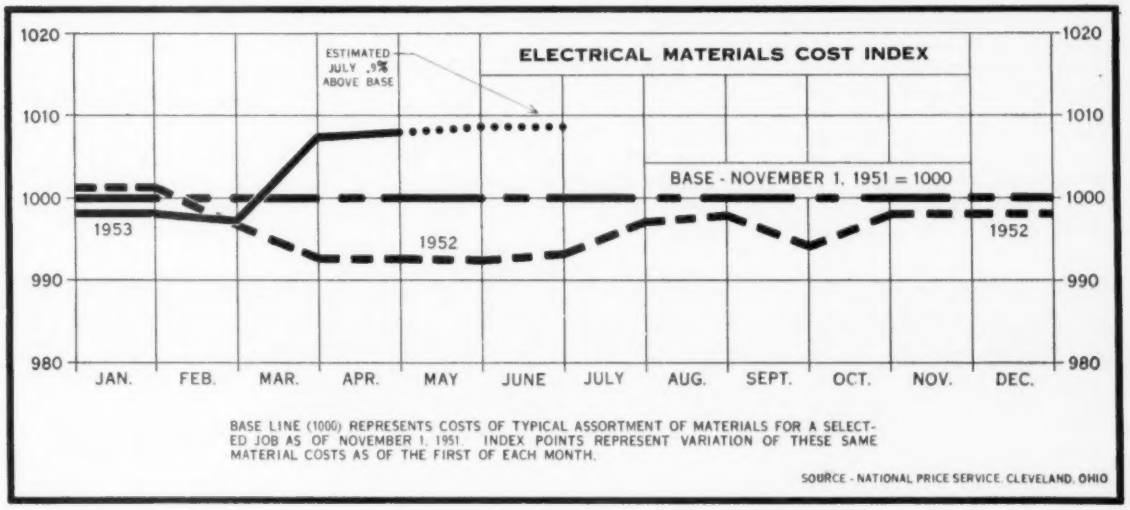
The remote eye of a closed circuit industrial television apparatus can keep untiring watch and report accurately. We expect great growth in the use of this versatile new industrial tool and because the application, installation and care of such apparatus will come within the responsibilities of our readers, we shall report on practical installations as new uses are found. This month J. F. McPartland, Jr., gives us an on-the-job report of an installation devoted to two separate tasks, smoke stack watching and water level watching in one of New York City's large power plants. See "A Case Study in the Application of Industrial Television" on page 74.

Service Continuity

Dependable electrical service is nowhere as vital as in the modern hospital. More than just facilities for standby or alternative supply is needed. The entire electrical system must be considered in the light of maintaining the flow of energy to many utilization requirements which must be ready at all times. The electrical systems for Detroit's new Sinai Hospital was designed by Albert Kahn and installed by Gray Electric Company with special emphasis on continuity and safety of electrical services. "Service Continuity" begins on page 78.

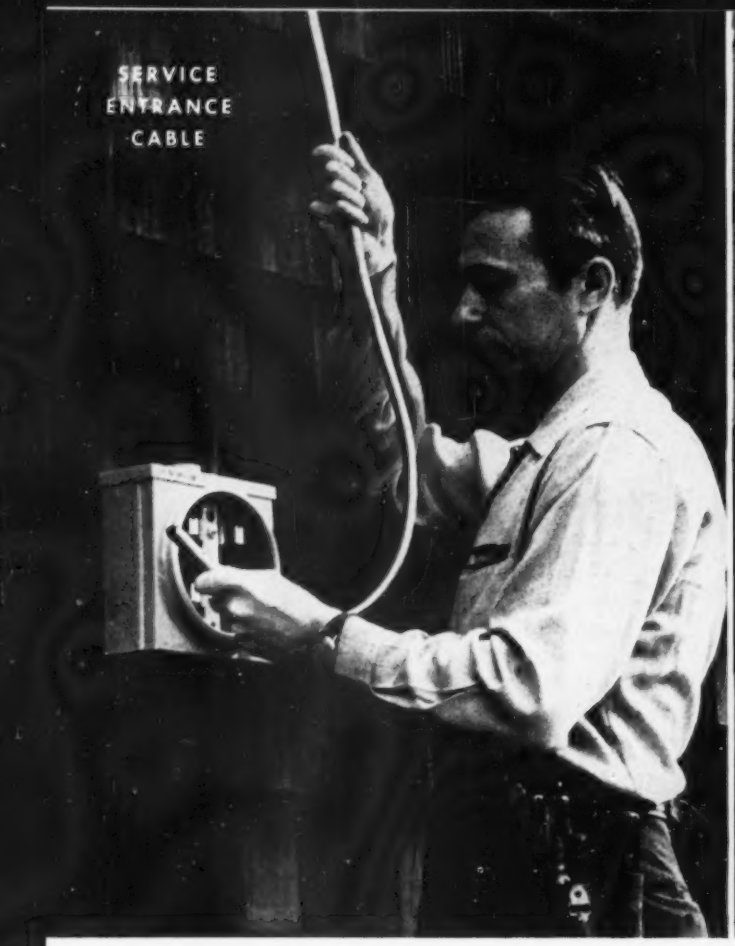
Clues

Many fires of unknown origin are likely to be ascribed to electrical causes. Occasionally, however, the experts can find important clues in cases where damage is limited or fire has not destroyed the evidence of its cause. One such case is described for us by B. A. McDonald. A fortunate combination of circumstances in this case study averted a serious fire and left, in the damage to a plumbing system, important clues to the course of an electrical failure which under other circumstances might have been destroyed. The report "Electrical Damage Without Fire" begins on page 83.



BASE LINE (1000) REPRESENTS COSTS OF TYPICAL ASSORTMENT OF MATERIALS FOR A SELECTED JOB AS OF NOVEMBER 1, 1951. INDEX POINTS REPRESENT VARIATION OF THESE SAME MATERIAL COSTS AS OF THE FIRST OF EACH MONTH.

SOURCE - NATIONAL PRICE SERVICE, CLEVELAND, OHIO



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You save time when you go right to the range with SILVALINE

You can run SILVALINE* Service Entrance Cable from pole or weatherhead to range or water heater . . . avoid trouble from damp cellars or crawl-spaces. You save, too. SILVALINE—furnished with copper or aluminum conductors—costs less to install *and* buy. Conduits are not needed.

SILVALINE is the only Type SE cable with URC saturant and finish—an exclusive ANACONDA feature that assures long protection and a smooth surface. Over this, a silvery paint is applied which, when the cable is installed, will take any type or color of house paint. The URC saturant will not come through even a single paint coat!

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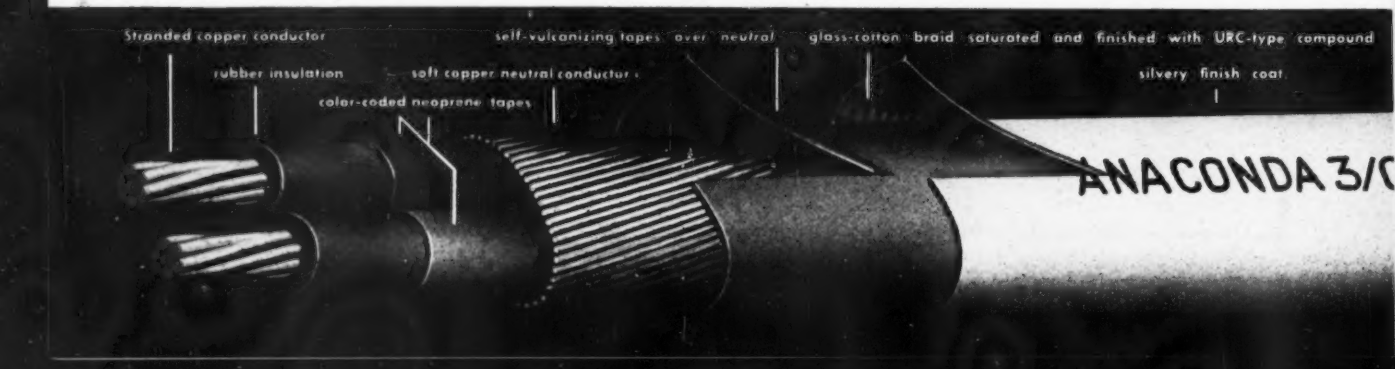

ELECTRICAL CONSTRUCTION AND MAINTENANCE

52nd Year—JUNE • 1953

Underground Services

AROUND THE SECOND DECADE of the century when we connected houses to supply lines, air and rugged porcelain were inexpensive and thoroughly reliable insulations. Service drops swung through the trees from the pole to a point high on the house. Small conductors broke under extreme stresses in storms, but they were easily repaired. For those times and state of electrical development the overhead service was a good, safe and practical installation.

IN THESE MID-CENTURY YEARS we cling stubbornly to the same tradition. The service drop swings through the trees from a pole to a point high on the house, or if the house isn't high enough, to a mast or other extension. The delicate metallic threads have gone. Service drop cables are from ¾ to 1½ inches in cross-section; big, strong, awkward and ugly. Storms can tear them loose from the terminations, but they won't break. Modern insulation and cable assemblies no longer need air and porcelain for reliability. For these times and state of electrical development the overhead service is not as good, nor as safe, nor as reliable as a well designed underground installation.

THE DIE WAS CAST when service drop cable replaced traditional single conductors using air and porcelain as the insulating materials. The elements, no longer useful, are now destructive. Greater size and strength of cables have shifted the storm risk from wire breakage to much more potentially hazardous damage to the point of attachment. The "merits" of underground vs. overhead service drops have been reduced to a question of cost.

EVEN THE COST GAP is closing. With large service conductors, mechanical trenching and modern developments in direct burial cables the difference in cost between underground and overhead services is no longer basic. More than likely, for a given project the prevailing codes, installation rules or utility practices affect costs more significantly than any essential differences in the functional materials and labor used.

UNDERGROUND RESIDENTIAL SERVICES will eventually become standard, however, not on engineering or cost considerations, but on appearance. Overhead service drops and service entrances cannot be made attractive, neither can they be made inconspicuous. The trends in residential utilization offer a prospect of bigger and still more conspicuous installation. The situation is further aggravated by modern residential building which insists on low roof lines.

THE PREVALENCE of overhead services to modern ranch type homes in new developments would indicate the need for better public information on the subject. Obviously the slight additional cost for undergrounding cannot be the compelling reason for installing some of the incongruous eye-sores which pass for electric service connections today. More probably the owner was never offered a choice at any price.

THE TIME HAS COME to take services down out of the trees and off the walls. They belong underground. They can be installed underground today at no great economic burden to the home owner. The great traditions of overhead open wiring deserve to be preserved in historical literature, not in contemporary construction.

Wm. T. Stuart

WHATEVER THE SIGNALING NEED — you can get the proper equipment from your local Graybar office. Edwards Lokator code-paging or calling systems . . . Webster intercommunication systems . . . USI sound-powered telephones . . . fire alarm systems . . . *plus* bells, buzzers, horns, sirens, howlers — *all* are reliable products made by leading manufacturers. Call your near-by Graybar Representative for complete information on any item.

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Because Graybar distributes a complete line of signaling equipment, you can get all of your needs from a single convenient source. Your purchasing problem is simplified . . . you take full advantage of Graybar's nation-wide warehousing system . . . you can be sure of prompt, on-schedule deliveries.

In addition, Graybar distributes *everything electrical* for wiring, lighting, power, and ventilation—over 100,000 items in all. *Graybar Electric Co., Inc. Executive Offices: Graybar Building, New York 17, N. Y.*

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FORD . . . of DEARBORN

Outstanding Electrical Construction

Ford's new Styling Building in Dearborn sets completely new standards for lighting. Louvered panel ceilings, cove lighting and recessed lighting equipment provide intensities ranging up to 200 footcandles for its 295,000 square feet of floor space. Power is supplied by underground primary feeders to two 2000 kva unit substations located in building, and distributed over 480-volt, 3-phase, 3-conductor busduct to transformers.

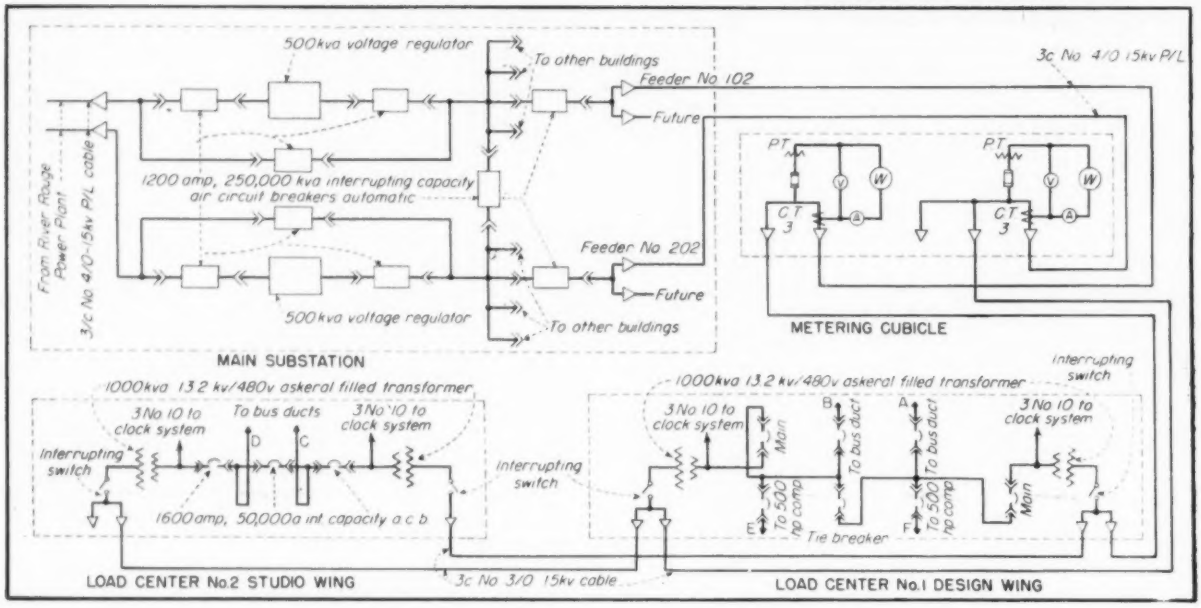
LIGHT will play a major role in the operation of Ford Motor Company's new Styling Building, a $11.5-million project of reinforced concrete with brick, limestone and aluminum exterior. Fourth in a series of new buildings at the new Ford Research and Engineering Center in Dearborn, Michigan, its 295,000 square feet of floor space has been provided with a high intensity of improved quality illumination which establishes new lighting standards for offices, drafting and vehicle modelling areas. Its construction, begun over two years ago, fittingly coincides with Ford's Fiftieth Anniversary celebration.

Power for the new Styling Building is principally for lighting and air conditioning, plus miscellaneous small motor loads required in the operation and maintenance of the building. Four 1000 kva transformers have been installed to supply this power for the engineers and stylists who will design future cars, trucks and tractors for the company. Space has also been provided for four similar future transformers, and the building can be converted easily to defense purposes.

The new Ford Research and Engineering Center, when completed, will occupy a 750-acre tract. The existing buildings and future buildings already under consideration will provide an $80-million center for research and engineering. Present plans call for completion in 1958 as a memorial to the late Henry and Edsel Ford. Power facilities for the entire project have already been completed in the form of a large substation fed by 13,200-volt primary service from the River Rouge power plant located about four miles from the Research Center.

The new Styling Building consists of a curving two-story design and office wing, a studio wing, large display rotunda, and outdoor display with turntable.

The design and office wing will contain executive offices, programming and scheduling section, trim and color section, and advanced styling section. The studio wing contains the drafting room and styling studios where full-scale clay models will be made. The display rotunda is for the indoor display of new models, and is provided with three turntables for this purpose.



POWER DISTRIBUTION

DUAL FEEDERS supply electric power to the Styling Building from a main substation which serves the entire Research and Engineering Center. These feeders are each 3-conductor No. 4/0 15 kv paper and lead covered cable, run underground in 4-in. conduit, and supply power at 13,800 volts, 3-phase, 60 cycle, delta-connected to two load centers located in the basement of the building.

Primary power is supplied to the main substation at 13,800 volts over two feeders from Ford's River Rouge power plant, approximately four miles away. Service is underground on the 750-acre Center project, then runs overhead to the River Rouge property. The main substation consists primarily of two 500 kva oil cooled voltage regulators, plus 1200 A., 250,000 kva interrupting capacity automatic air circuit breakers, supplying 3-conductor feeders to the various buildings and services in the Research Center.

Two load centers, each of 2000 kva capacity, service the Styling Building. These are General Electric typical unit substations, with No. 1 serving the design wing, and No. 2 serving the studio wing. Space is provided at each substation to duplicate existing equipment, should more power be required.

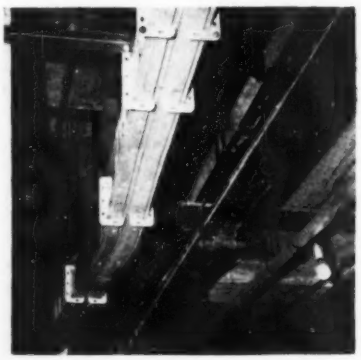
Each unit substation contains two 1000 kva 13.2 kv/480 volt askeral filled transformers. Primary service to each transformer is through an askeral filled interrupting switch. A 1600 A., 50,000 A. interrupting capacity air circuit breaker tie joins the two secondaries in each load center, and each sub-feeder is protected by similar air circuit breakers, rated from 1000 A. to 1600 A. according to loads being served.

Substation No. 1 serves two Trumbull 1200 A. bus duct feeders in the design wing, and two 1000 A. feeders to the two 500 hp compressor motors located in the design wing basement.

Substation No. 2 serves two Trumbull 1600 A. bus duct feeders in the studio wing. These two feeders, each 150 feet long, are run along the length of the basement corridor, end to end, and each length is fed by 12 600 MCM conductors run in four 3½-inch conduits along basement ceiling from substation to bus duct.

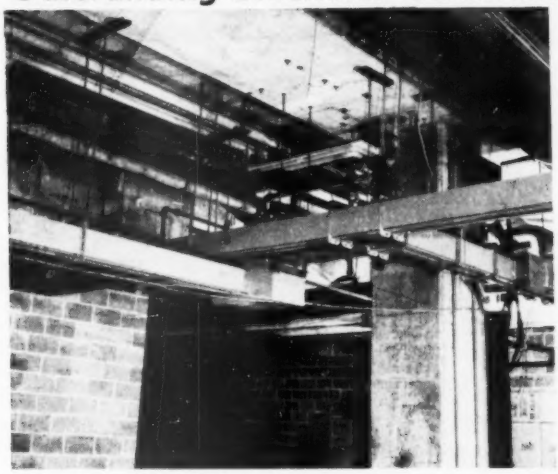
The 1200 A. bus duct serving the design wing runs along the ceiling of the curving basement corridor, and contains a 7-degree bend to provide the curvature needed to follow the corridor. Harlan Electric's job superintendent provided a full size template for this curving section by placing paper on the floor and using a plumb from straight runs on the ceiling, so that the building curvature could be obtained accurately.

All bus duct power is supplied at 480-volt 3-phase 3-conductor service. All motors on the entire job ¼-hp and larger are 480-volt motors served directly from the bus duct through power panels, with motor controllers in the branch circuits between the panels and motors. Utilization voltages for lighting and other miscellaneous services are obtained through the use of Westinghouse dry type transformers which are fed from the bus ducts. All transformers rated 25 kva and larger, up to 150 kva, are installed on concrete bases built up 10" from the floor, for protection. Small 10 kva transformers are Trumbull bus plug type.

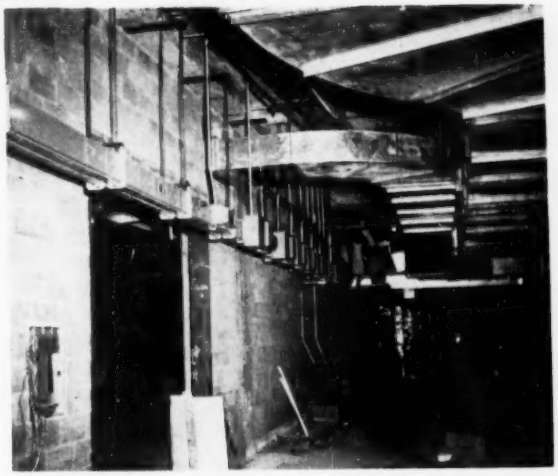


BEND in bus duct of 7 degrees was made at factory from template made on job to permit duct to follow curvature of basement corridor in design wing of the Styling Building.

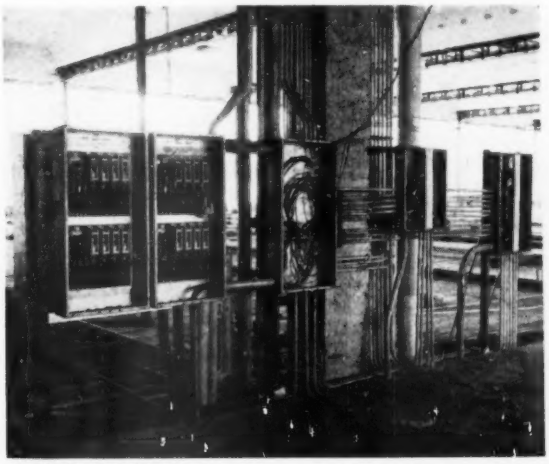
. . . Outstanding Electrical Construction



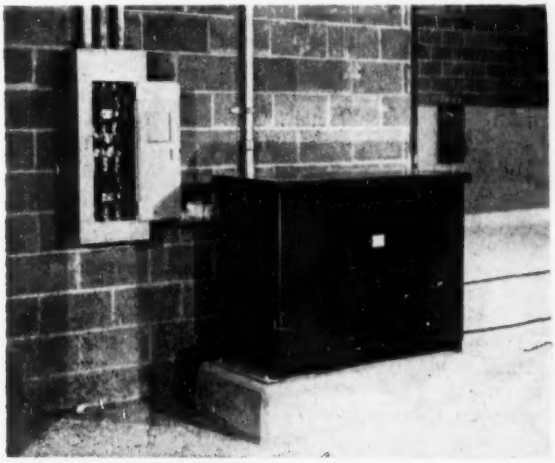
BUS DUCT JUNCTION in basement showing two parallel lines of 1600 A. 480 V. 3-phase 3-conductor bus duct.



BUS DUCT feeds auxiliary motors in adjacent compressor room directly through 100 A. and 200 A. fused bus duct plugs.



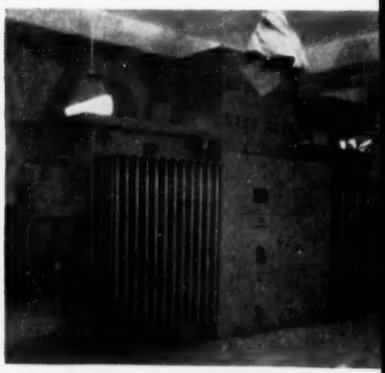
LIGHTING PANELS in corridor walls feed studio bays (background). Two panels at left have 4-pole remote control switches. Upper unit on one panel controls slimline lighting on one side of studio bay, lower unit at bottom controls slimline units on other side of bay.



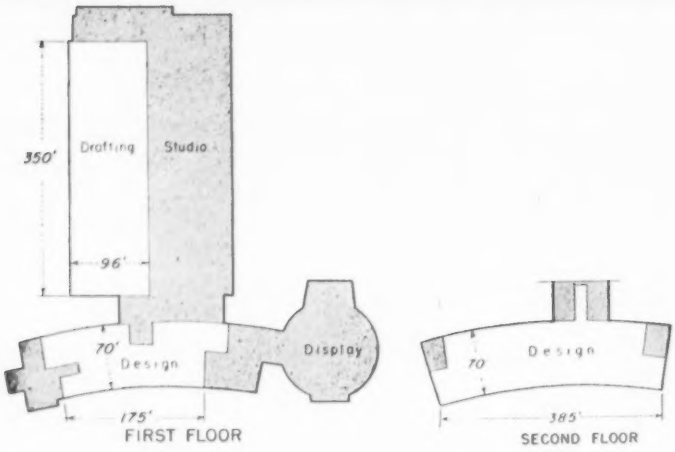
DRY TYPE TRANSFORMER of 100 kva capacity, 480/120/208 volt 3-phase Westinghouse Type AVR rests on 10-inch high concrete base in basement corridor, is fed from 480-volt bus duct overhead. At left is Automatic Switch Co. remote control switches in cabinet.

TWO FEEDERS from this main substation supplies power to Styling Building. Other feeders supply power to entire Research Center. Equipment consists of two 500 kva regulators and circuit breakers.

LOAD CENTER No. 1 and metering cubicle (right) is located in basement of design wing, which it supplies with power from two 1200 A. bus duct feeders and two 1000 A. cable feeders to two 500 hp compressor motors.



LOAD CENTER No. 2 is located in basement and supplies power to studio wing over two 150-foot runs of 1600 A.2 Trumbull bus duct at 480 volt, 3-phase, 60 cycle.



LIGHTING—
Offices and Drafting Room

THE DRAFTING room and all private and general office areas are lighted to intensities of 100 footcandles and above. Metal louver sections, using 45° x 45° shielding with 2 in. x 2 in. x 2 in. cell openings, are arranged in large panels divided by narrow strips of acoustical tiles, so that overall wall-to-wall area lighting is achieved. In the drafting room the louver panels are 32 ft. by 14 ft., and 24 ft. by 14 ft., divided by two rows of 12-in. acoustical tiles, while in the general and private office areas the louver panels are 8 ft. by 10 ft. All louver panels are formed by standard 4 ft. by 2 ft. module louver sections.

Slimline fluorescent lamps are installed in white metal reflectors 18 inches above the louvers, on approximately 15-inch centers. All lamps are 96-inch T12 standard white, except those used with a few small louver panels for unusual structural conditions, and are operated at 425 ma. by two-lamp high-power-factor ballasts. Ceiling height in the drafting room is 18 ft. 4 in., and in the office areas, both first and second floor, is 11 ft. 4 inches.

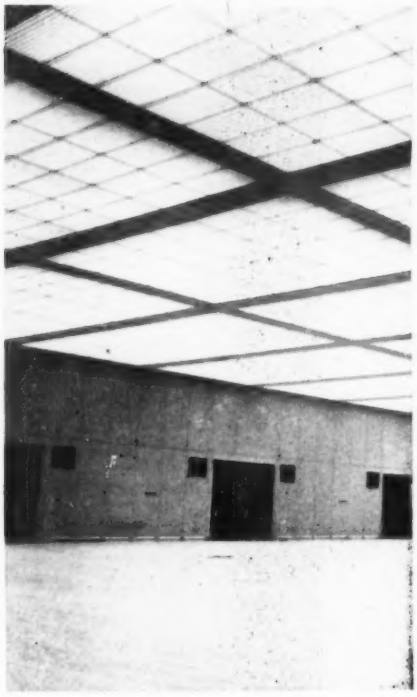
Power consumption, including ballast watts loss, averages 6.8 watts per square foot. In the drafting room, where 112 footcandles are provided, the coefficient of utilization is approximately 32%, with each watt-per-square-foot producing approximately 16.5 footcandles. These values are from 10% to 12% less in the general and private office areas in the Design Wing, where intensities range from 100 to 108 footcandles.

Believed to be the largest single installation of overall louver lighting in the world, the three separate areas have a combined total of over 65,000 square feet. The area of the drafting room alone is 33,600 sq. ft. In the Design Wing, which is in the form of an arc, the louver sections extend from one exterior wall to the other, over office areas and corridors alike. Standard 4 ft. by 2 ft. module louver sections are used, and the width of metal pans separating louver panels is varied to compensate for the different dimensions on the two sides of the room. This treatment creates the illusion of the louver panels being custom made. Even in the long narrow corridor, the louvers appear to be curved.

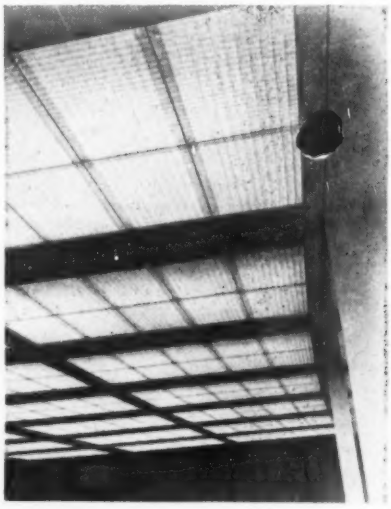
The louverall lighting, supplied by Smithcraft Lighting Division, integrates ceiling and lighting with the architecture and interior design. Being completely flexible as to dimensions, it creates an impression of custom-design, yet was supplied as standard units.

Each unit assembly consisted of hangers, hanger rod assemblies, ballast and lampholder housings, spacer tubes, reflectors, shielding framework, and louver sections. Once the hangers were installed in place on the ceiling, the electricians needed only a level and screwdriver to complete the installation. Reflectors were used on this installation due to the depth of the plenum, which conceals overhead beams, air ducts, heating pipes, etc. Because of the open louvers, air diffusers were centered above the lighting units and fed alternately from opposite sides.

FORD of Dearborn . . .

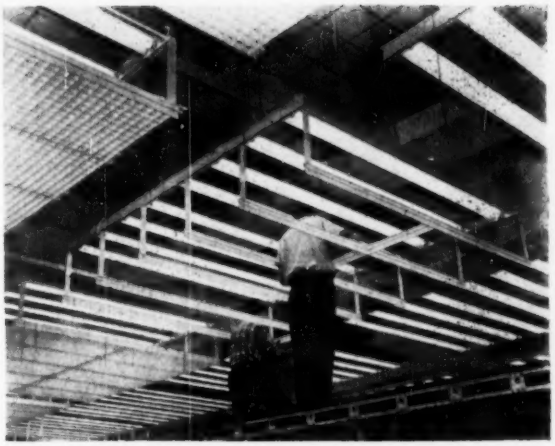


LOUVER PANELS form ceiling in drafting room, provide overall lighting wall-to-wall. Slimline lamps in reflec-

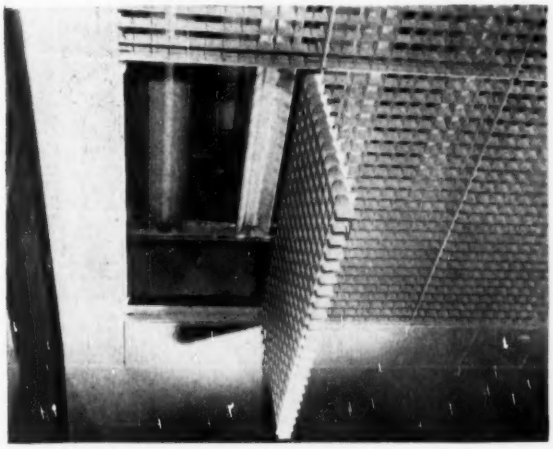


BUILDING CURVATURE is compensated for by varying width of metal pans between louver panels which use standard 4 ft. by 2 ft. louver sections. Illusion is created that the louver sections are curved.

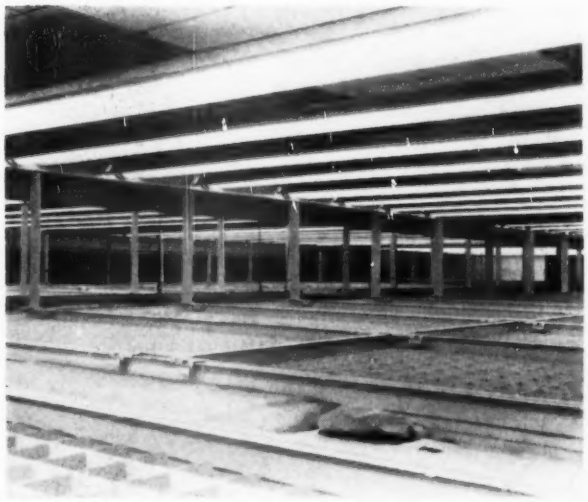
tors are installed on approximately 16.8-in. centers 18 inches above louvers, provide 112 footcandles average throughout 33,600 sq. ft. area. Ceiling height is 18 ft. 4 in.



UNIT ASSEMBLY for a complete louver panel is installed individually. Main and connecting runners for louver sections are here being attached to the electrical components framework, after which the louver sections are put in place. Runners support acoustical tile sections between louver panels.

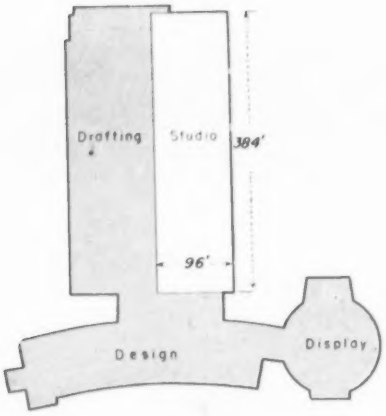


LOUVER SECTIONS are standard 4 ft. by 2 ft. modules, with 2 in. x 2 in. x 2 in. cells. Sections hinge from either side, are supported by hangers placed at junction of main and connecting runners. Lampholders are painted red on "hot" side for quick identification.



PLENUM between louver ceiling and acoustical tile on building ceiling above contains framework support for louvers, slimline lamps, reflectors, lampholder and ballast housings, supported by rod hangers from hanger plates in ceiling slab. Acoustical material fills space between runners in foreground.

OBSTRUCTIONS in plenum, such as beams, air ducts, heating pipes, etc., are concealed by suspending fixture assemblies below. Lamps and reflectors run at right angles in some cases, as in this view in the Design Wing, so that lighting layout conforms to obstructions. Main and cross runners and hangers have not been installed in this view.



FORD of Dearborn . . .

LIGHTING—

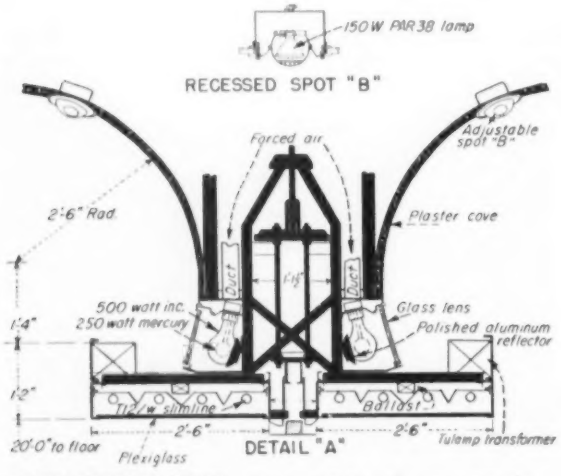
Styling Studios

LIGHTING OBJECTIVE in styling studios is to provide shadowless illumination over entire full-size clay models, such as shown here being worked on by expert clay model team. Uniform horizontal and vertical illumination of high intensity and good spectral quality is desirable.

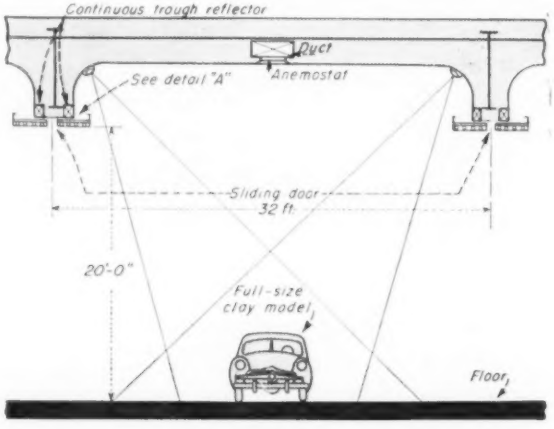
THE STUDIO wing, which extends perpendicularly 3?6 feet to the rear of the design wing, is the workshop of Ford design stylist engineers. On the north side of this wing are 12 individual studios, each 32 feet wide by 96 feet long. It is here that full-size clay model work will be done. Expert clay model workers will skillfully interpret in accurate detail the results of Ford research and engineering for the finer cars of the future, including interior styling of each product line's trim schemes, instrument panels, steering wheels, mouldings and other appointments.

Walls between each studio are motor-operated sliding doors, which can be opened for a clear view through the entire wing, or closed to provide individual studios. Thermopane window sections 18 feet high form the exterior wall for the entire length of the studios. Finished clay model designs can be moved easily from any one of these studios into the adjoining display garden, in which a turntable is centrally located to permit day viewing of the new designs by company engineers and executives.

The lighting objective in the styling studios has been to provide the best possible quality and quantity of illumination, to insure even lighting over the modeling work and accuracy of detail with maximum seeing comfort.



COVE CROSS-SECTION shows details of cove troughs, fluorescent panels, and method of mounting. Forced air circulates through cove troughs to maintain normal temperature on mercury vapor lamps, and to dissipate heat.



SECTION THROUGH STUDIO

UNIFORM LIGHTING over entire model is provided by specially designed cove lighting system, supplemented by diffuse direct fluorescent lighting and ceiling recessed floodlighting for maximum vertical illumination on sides of model.

. . . Outstanding Electrical Construction

ANGLE IRON SUPPORTS for special cove lighting troughs and fluorescent panels are shown here, during construction, before lighting equipment was installed. Adjustable spots are already in place. Prismatic glass lenses in cove trough control light, provide narrow fan-shaped light beam.

STUDIO CEILING is uniformly lighted from cove-to-cove by combination incandescent and mercury vapor lamps in cove troughs, alternating on 12 inch centers, to provide excellent spectral quality diffuse illumination. A 2-foot wide continuous lighted panel is suspended under each cove.

An unusual lighting treatment was developed by the building architects to satisfy the lighting objective. It is basically a high intensity cove lighting treatment, supplemented by floodlighting from carefully positioned rows of concentrating spotlights, and by continuous rows of fluorescent panels for diffuse direct lighting. The cove lighting provides evenly diffused light throughout the entire area, and the spotlights highlight the models, providing both horizontal and vertical illumination on the work areas. The fluorescent panels add diffuse direct light for increased vertical illumination on the work; also, illuminates the underside of the coves to relieve contrast between the lighted ceiling and the bottom side of the coves.

The lighting intensity in each studio averages about 180 footcandles, with intensities on the work areas exceeding 200 footcandles.

Each studio contains 3,072 square feet of floor space. The lighting equipment in each studio uses 85,372 watts, or 27.8 watts per square foot, to provide the illumination. This includes the watts loss in auxiliary ballasts, and transformers for mercury vapor lamps.

The two coves in each studio are each 93 ft. 4 in. long, and contain 47 500 watt incandescent lamps on 24-inch centers, which alternate with 46 250 watt mercury vapor lamps on 24-inch centers. Specular Alzak parabolic reflectors are used with the incandescent lamps, and specular Alzak cylindrical reflectors are used with the mercury vapor lamps. Corning prismatic glass lenses redirect the light rays from both lamps into a narrow fan-shaped beam of light which illuminates the ceiling evenly. The center punch of each beam of light is directed to the center of the arched ceiling, and the lenses are located below a line of sight extending across the width of three studios. Forced air ventilation through the cove troughs is used to maintain a normal ambient temperature around the mercury vapor lamps, so that they will operate at maximum efficiency. This also helps to dissipate the heat load directly, rather than through the air conditioning system.

Incandescent and mercury vapor lamps were combined to provide a better spectral quality of illumination. The result is an excellent "white" light which closely approximates daylight.

The fluorescent panel lighting under each cove trough uses four rows of standard white slimline lamps operated at 425 ma. These lamps are staggered between rows, to prevent dark spots at the end of the lamps.

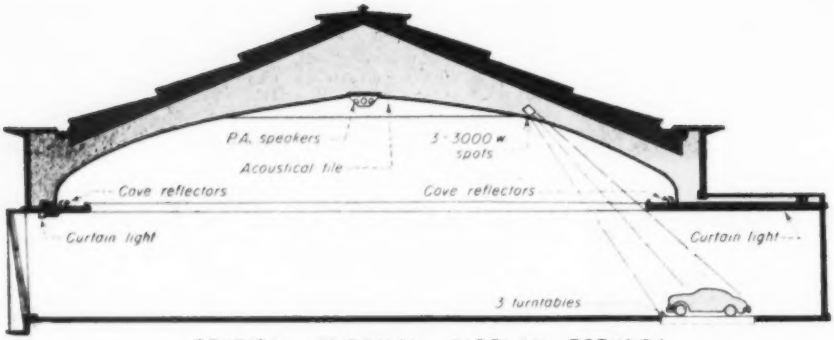
Flat sections of Plexiglas were used for the panel lighting, with a light diffusion and transmission characteristic which closely approximated the brightness of the cove lighted ceiling.

Three branch circuit lighting panels are used to supply power to the lighting equipment in each studio, and are located in the basement area below. One panel is used for the fluorescent lamps and incandescent spotlights. Another is used for the mercury vapor cove lighting, while the third is used for the incandescent cove lighting. Three-way wall switches located in the studio control 3-pole remote control contactor switches located in the basement, which in turn control the branch lighting circuits to the studio.

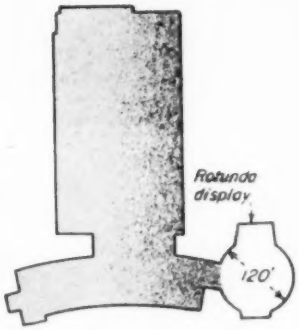
Total lighting load for the 12 studios is 1,025 kw., and the total area is 36,864 square feet. Additional electrical facilities include motors for operating the window wall doors to the outdoor display area and folding walls between studios, and for ventilating fan motors used to ventilate the cove lighting troughs.

The lighting load in each studio is balanced between the three phases. Branch circuits to lighting equipment are No. 10 General Electric Type AVA wire, other circuits are type RH wire.

All cove lighting troughs, ceiling adjustable spots, and fluorescent panel lighting equipment in the studios, including metal supports, hangers, etc., were supplied by Gruber Lighting, Inc., and were custom-designed and made specifically for this installation.

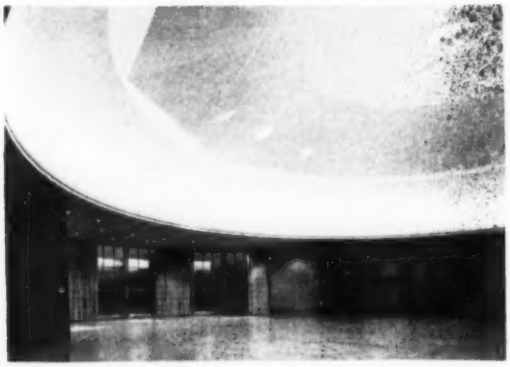


SECTION THROUGH DISPLAY ROTUNDA



LIGHTING—

Display Rotunda



DISPLAY ROTUNDA provides dramatic setting for display of new Ford models. Area is lighted by dimmer-controlled cove lighting to 125 footcandles general lighting, supplemented by 3-color color lighting and 3000-watt spotlights to highlight models on turntables.

ANOTHER unusual and dramatic feature of the Styling Building is the cove lighted display rotunda. Located at the north end of the curving design wing, this showroom is 120 feet in diameter, with an arched ceiling 42 feet high at the center.

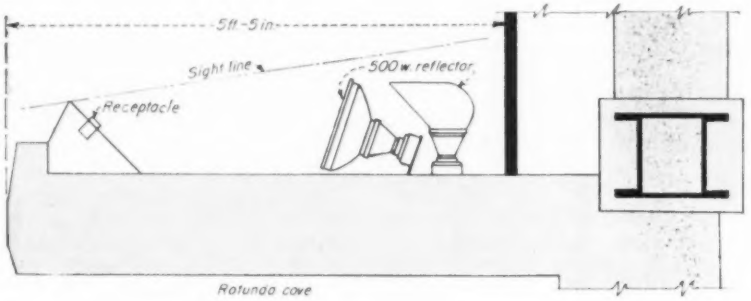
A total of 600 Curtis X-Ray reflectors, each equipped with a 500-watt standard incandescent lamp, are installed in this cove which circles the room. There are two types of reflectors, and each type is on approximately 15-inch centers. One type has an asymmetric fan-shaped light distribution for lighting the arched ceiling near the cove, while the other has a highly concentrated light distribution for projecting the light to the center of the dome, thus lighting the entire ceiling to a uniform brightness.

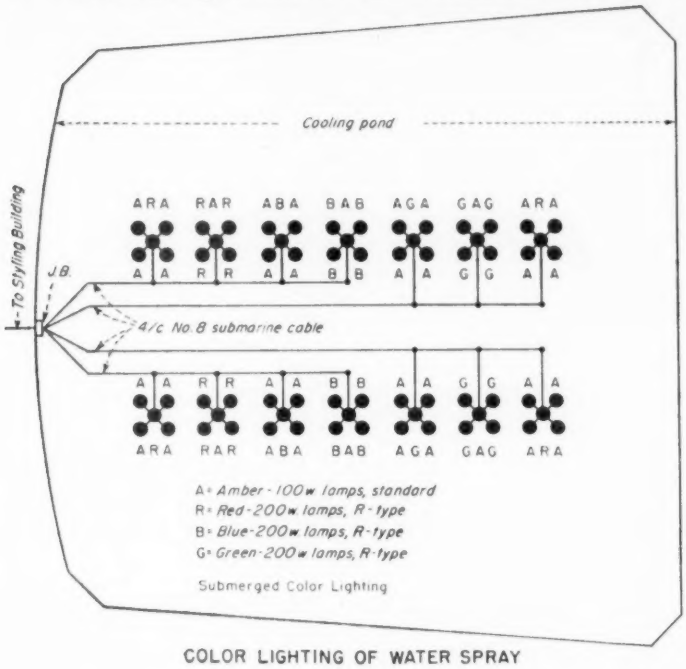
The 300 kw cove lighting system alone consumes approximately 26.5 watts per square foot. It provides a maximum intensity of 125 footcandles, or an average of 4.7 footcandles per-watt-per-square-foot when new, resulting in a coefficient of utilization of approximately 24%.

On the east side of the rotunda is a 42-foot wide window 20 feet high, with folding curtain. On the opposite side is a curving 20-foot high window approximately 74 feet long, facing the outdoor garden, also equipped with a folding curtain. Standard incandescent borderlights light each of these curtains in three colors—red, blue and amber. Six strips, containing 54 100-watt lamps light the short curtain, and nine strips, containing 81 100-watt lamps, light the curving curtain.

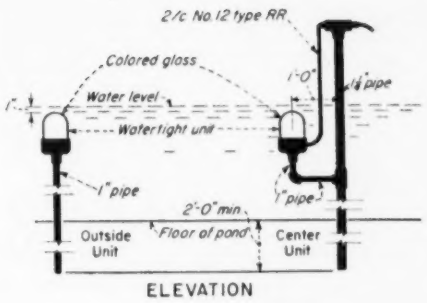
In front of the large curving window are three motor-operated turntables, each 18 feet in diameter, which are provided for the inspection and selection of proposed new model cars and trucks. Each is highlighted by a 3000-watt Kliegl spotlight recessed in the dome ceiling.

The cove lighting, curtain lights, and a four-color system of color lighting of water spray in the cooling pond, are dimmer controlled by a Trumbull Electric dimmer of the reactor and hysterset type, located above the ceiling in the rotunda. The switching and remote control panel is located on the rotunda wall near the east window.

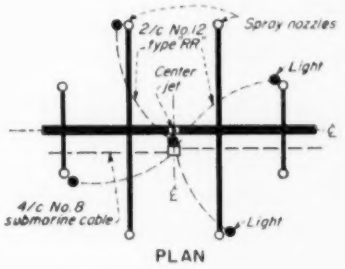



Cooling pond
To Styling Building
J.B.
ARA RAR ABA BAB AGA GAG ARA
4/c No. 8 submarine cable
A= Amber - 100w lamps, standard
R= Red - 200w lamps, R - type
B= Blue - 200w lamps, R - type
G= Green - 200w lamps, R - type
Submerged Color Lighting

COLOR LIGHTING OF WATER SPRAY



ELEVATION



PLAN

LIGHTING—*Exterior and Grounds*

EXTERIOR lighting is used for both utilitarian and decorative purposes. All roadways around entire building are lighted by Daunt lantern-type luminaires installed on fluted metal poles 15 feet above ground, and equipped with symmetric, A-symmetric and B-symmetric prismatic refractors as required.

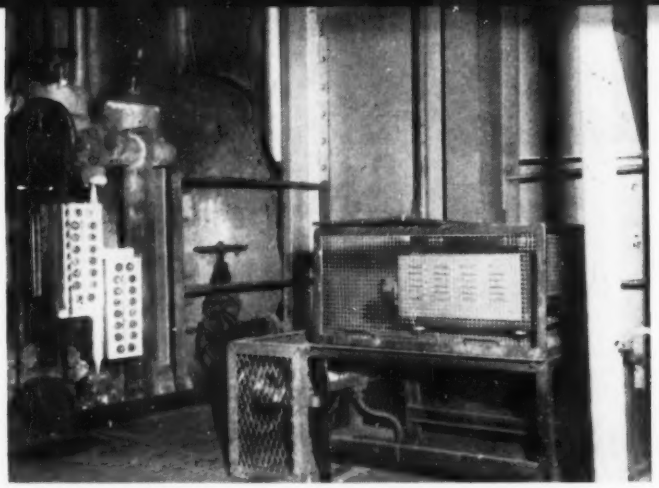
The west cooling pond, immediately in front of the building to the east, is color lighted. Groups of nine-nozzle sprays are installed in two rows of seven groups each, about 40 feet apart, with the rows running perpendicular to the face of the building. At each group of nine nozzles, five Russell & Stoll No. 2369 globe type fountain lights are installed with the top of the globes 1-inch below the level of the water when the spray is turned on. Globes are in four colors—red, blue, green and amber—and arranged with the center light at each group in one color, while the four outside units are in a different color. These colors are varied from group to group, according to a pattern, to provide a predetermined artistic color effect.

All color lighting in the pond is dimmer controlled from the reactor dimmer located in the Display Rotunda. Wiring from a junction box at the edge of the pond is by means of Simplex 4/C No. 8 Anhydrex neoprene jacketed cable laid on the floor of the pond. Leads to each light are of No. 12 Type RR wire, from a receptacle at each group fed by 4/C cable.

The Styling Building project was designed by Voorhees Walker Foley and Smith, architects and engineers, New York City, working in close harmony with the Building and Facilities Department, Engineering Staff and the Plant Engineering Office, Central Staff, of the Ford Motor Company. Bryant and Detweiler of Detroit were the general contractors, and all electrical construction and installation work was done by Harlan Electric Company, electrical contractors of Detroit.

EXTERIOR LIGHTING creates a dramatic picture of the Styling Building by night, artistically highlighting the facade of the curving design wing and fluted exterior of the display rotunda.

VIEWING MONITOR on boiler control board (arrow) provides boiler operator with a continual picture of the water-level gages on the drum.



TELEVISION CAMERA, in protective cage, is focused on the water-level gage high up on the boiler; uses 150-watt spots to light the gage to sufficient intensity.

A Case Study in the Application of . . . INDUSTRIAL

An on-the-job report of closed-circuit television equipment as used in one of New York City's large power generating stations, covering installation and wiring details, operating fundamentals, and practical maintenance procedures.

INDUSTRIAL television, commonly called ITV, is today used to practical advantage at the Waterside Generating Station of the Consolidated Edison Company, New York, N. Y. Here, multiple arrangements of cameras, receivers and associated power supply units are integral parts of the plant's control system and important elements in the operation of the plant. Providing remote-vision to boiler operating personnel, ITV enables them to observe from their control panels widely separated points inside and outside the plant, increasing overall safety, dependability and efficiency of boiler operation. A close look at this installation will point up some of the capabilities of ITV and its broad application potential.

Equipment Layout

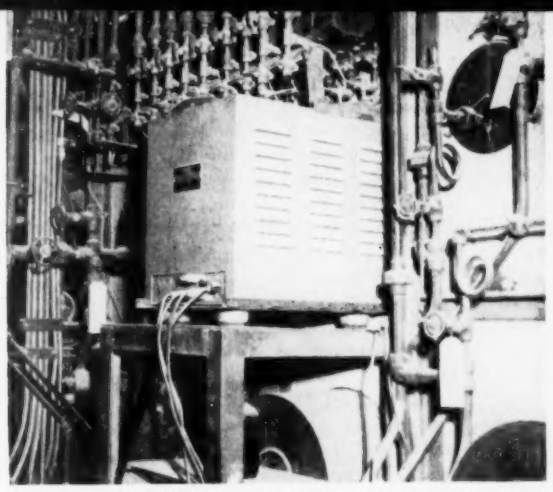
At Waterside, five separate ITV systems provide remote-vision for constant observation of (1) water-level gages high up on the boiler drums and (2) the density of smoke output from the plant's three large smokestacks. In the first case, a separate closed-circuit system is used for each of four boiler drums to provide a clear continuous picture of the gage on viewing monitors at control panels. For observing the smokestacks, one system reproduces a picture of the stacks on six monitors strategically located inside the plant.

The four systems for observing water-level gages are similar in installation detail; although each is a separate closed-circuit system (Fig. 1). In the typical setup for gage observation, the television camera, recording the image of the gage, is located directly opposite the gage on an upper tier of the platform structure around the vertical rise of the boiler. The camera unit is mounted in a protective cage on a small steel table and is focused on the area of the gage. Immediately in front of and below the camera cage, another cage enclosure houses two 150-watt spotlights. These spots are focused on the gage, providing the high lighting intensity necessary for effective pick-up of the image by the camera.

About 40 feet from the camera position for each boiler drum, a power supply unit and a voltage regulator are mounted to a structural steel member up against the boiler superstructure. Power for the individual system is delivered at 115-volts, 60 cycles to the V-R, then through the power supply unit to the camera. The regulator is used to assure stability to the ITV system in the event of fluctuations in the distribution voltage in the plant. The power unit is connected to the camera by a 50-foot run of 13-conductor cable in conduit, carrying the operating voltages and signal voltages. Conduit risers from the power unit carry the coaxial cable feeding the video signal and horizontal and vertical sync pulses down to the two monitors which reproduce the camera image of the gage. One of these monitors is mounted on a panel in the main boiler control room on the floor level of the plant; the other is mounted on a control panel at the water pump station, adjacent to the boiler on a tier midway between the floor level and the gage level. Additional conduit risers from the regulator feed power conductors down to the two monitors.

Equipment layout for the smokestack "watchman" is simple, its wiring direct (Fig. 2). The camera for this single system is located in another Con Edison building, three blocks away from the plant. In a small room on the top floor of this six-story building, the camera is mounted on a tilted plat-

SECOND MONITOR coupled to the camera at the gage-level is located on panel at the water pump control station, informing pump operator of the water level in the drum.



MONITOR MOUNTING at the rear of the main boiler control panel consists of a high steel table on which the monitor is placed with its face projected through the panel.

TELEVISION

By J. F. McPartland, Jr.

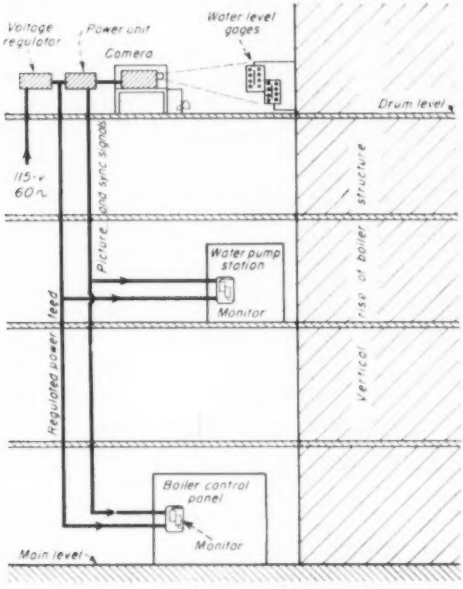
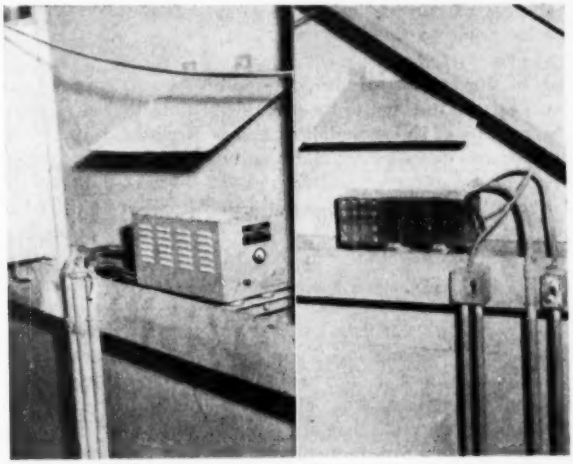


FIG. 1. Equipment layout for each of the four gage-watching systems.



POWER SUPPLY and voltage regulator (right) are mounted to a structural member on the gage level, about 40 feet from the camera which they supply.

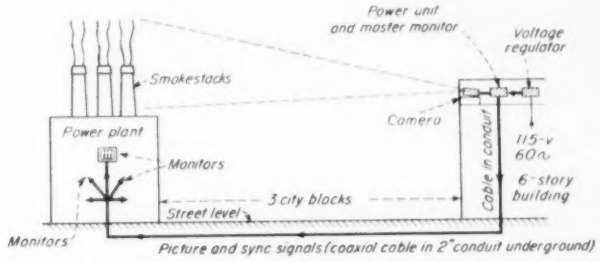


FIG. 2. Basic hook-up diagram of the closed-circuit ITV system used for observing the density of smoke output from the stacks.

form on a table and faces out the window toward the smokestacks. A power supply unit for this system and a master monitor are mounted on the table alongside the camera. Here again, the power supply is fed at 115-volts, 60 cycles through a voltage regulator.

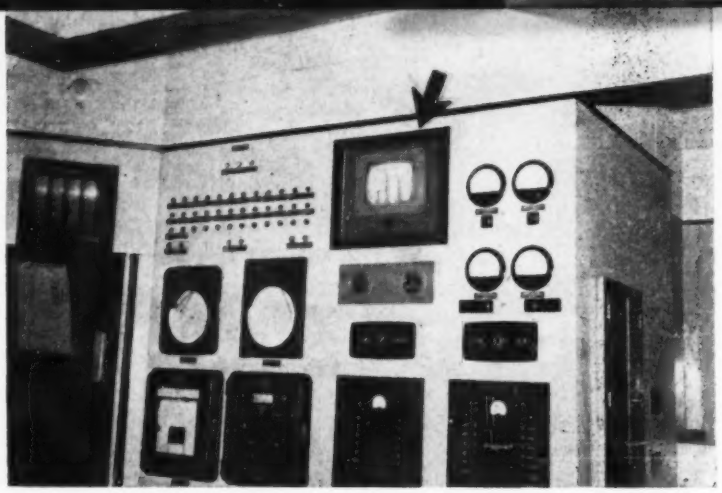
Transmission of the smokestack picture to the viewing monitors in the plant is made over the closed circuit. The electrical signal of the picture picked up by the camera is fed by coaxial cable from the camera, back through the power supply unit, down conduit risers, then underground to the plant. In the plant, the system conductors are distributed in conduit to the six monitors. One monitor showing the smokestack picture is mounted on a panel in each boiler-control room; one is located in the office of the plant supervisor for his constant inspection of the density of smoke output.

The stack-watching ITV system is controlled by an astronomical time clock which automatically keeps the system operative only during that part of the day when natural light is sufficient for effective pick-up of the stack

image. To compensate for variations in natural light during the operating period, the camera is equipped with an automatic iris control. For this control, the electrical picture signal from the camera is constantly fed through a small electronic circuit which measures the relative brightness of the image picked up by the camera and triggers a small 24-volt dc motor coupled to the iris, increasing or decreasing the camera aperture. In this way, the lens opening is constantly adjusted to assure constant brightness of the pictures transmitted to the monitors.

Prior to the installation of the remote-vision systems, an arrangement of mirrors was used to relay a view of the gage from the drum-level gage location down to the operator's level. It was necessary to have a water tender observe the reading of the gage and report this information to the operator. The use of ITV has eliminated the need for the water-tender and greatly increased the accuracy and reliability of information available to the operator.

Smoke control and the interest of plant supervision in efficient boiler operation have created much interest in ITV as a smoke-watcher. At Waterside, six remote "eyes" are constantly on the watch for any stack which might start blowing objectionable smoke. Corrective measures can be taken in minutes. Both the stack-watching and gage-watching systems are "fail-safe" indicators. If the equipment is working properly, accurate information is relayed to the control panels; if it isn't, no information is relayed. There is no possibility of misinformation being provided to operators.



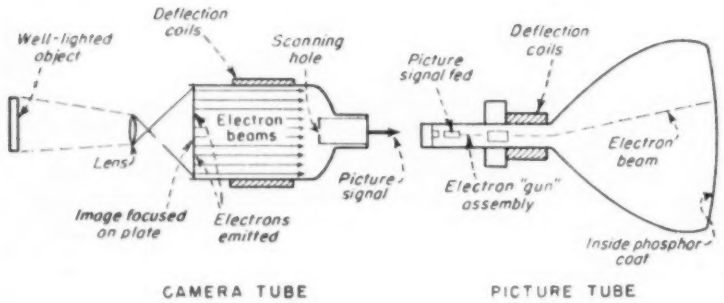
SMOKESTACK WATCHMAN is the job of one ITV system feeding a picture of the smoke output from the stacks to six monitors, including the one above (arrow) in the main control room.

Operating Fundamentals

Although two different types of ITV systems are used at the Waterside Station, they are both closed-circuit systems and are fundamentally similar in operation. The description "closed-circuit" indicates the major difference between industrial television and commercial television. In the commercial system, the electrical equivalent of the camera image is transmitted through the air by means of electro-magnetic carrier waves which are picked up by receiving antennas. In ITV systems, image transmission is made over a direct coaxial cable hook-up between camera and monitor. This difference accounts for the relative simplicity and greater dependability of ITV. And, of course, the absence of simultaneous audio transmission in the case of ITV further simplifies the system and reduces the size of equipment required. ITV requires no license from the Federal Communication Commission for its installation or operation.

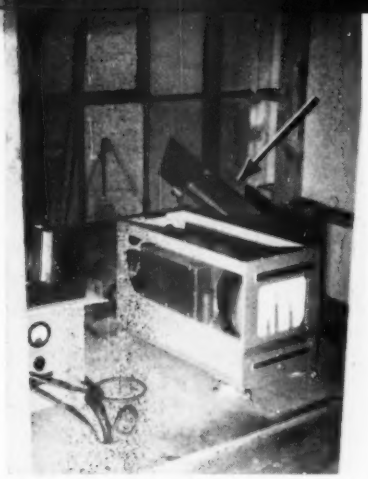
In any ITV system, the transmission sequence begins at the camera, which converts the picked-up image into an electrical current. Although there are three types of camera tubes which can be used, one, the image-dissector type, has had widest use. The camera lens, focused on the well-lighted object before it, optically picks up an image of the object and reproduces it on a treated plate in the camera tube. Excited by the varying light intensities of the image, the coated plate gives off electrons which are attracted to an anode at the other end of the tube. A varying electrical current from this anode is amplified and fed to the coaxial transmission line. The receiving monitor further amplifies the electrical signal and the camera image is re-created on a cathode-ray picture tube. Coaxial cables are necessary because the line must effectively transmit signals of high frequency (several million cycles per second) which would be completely attenuated or soaked up in conventional circuit wiring.

How ITV Relays a Picture



The operating sequence of an ITV system begins at the camera. As shown in the illustration (left), the camera lens is focused on the well-lighted object (a gage or smokestacks), optically reproducing an image of the object on a specially-treated plate in the camera tube. This plate is so coated that any point on the plate will give-off electrons in direct proportion to light intensity at that point.

Inasmuch as the image focused on the plate consists of thousands of points of light with the intensity at each point corresponding to some shade between light and dark in the whole image, there is a varying release of electrons over the area of the plate within the tube. From each of the



CAMERA LOCATION for the stack-watching system is the top floor of a 6-story building, 3 blocks from the plant.

This brief description of the operation of an ITV system applies directly to the gage-watching systems used at Waterside. The stack-watching system varies in that the amplified camera output is passed through additional electronic circuitry before being transmitted to the monitors. The stack system is more sensitive, offering higher resolution and other factors which add to picture quality. The requirements of smokestack observation necessitated better picture quality.

ITV systems have been designed to meet the special requirements of industrial application. As shown in the Waterside installation, the basic equipment consists of unitized assemblies which afford ready block hook-ups and occupy a minimum of space. Operation can be expected to be dependable under a wide range of normal and adverse conditions. Such factors as size, portability, complexity, picture quality, long life and initial cost have been resolved to serve industry's particular demands.

Although the two applications of ITV at Waterside indicate its advantages and capabilities, they by no means represent standardized installation technique. Depending upon the extent and purpose of any ITV installation, application-engineering is an important factor in the effective use of ITV. Seldom is the basic equipment sufficient for a particular application, without need of special hangers, mounts, housings and other accessories.

Practical Maintenance

At the Waterside plant, the electrical engineering department maintains the ITV equipment. For the most part, maintenance is a matter of regular cleaning. Camera lenses and monitor faces must be kept free of accumulations of dust and dirt, and enclosures must be blown out periodically to eliminate heavy layers of dust which enters through the ventilation openings and adheres to statically-charged surfaces. Hook-up conductors between system components require frequent wiping to remove the very heavy layers of dirt and foreign matter which adhere to their highly-charged surfaces. Proper cleaning on a frequent schedule is important to satisfactory operation of the systems; heavy dust causes overheating and breakdown of coils, resistors and other small parts.

Servicing of the equipment, a minimum requirement by design, involves standard electronic testing procedures, occasional readjustment and replacement of defective parts. For this work, servicing personnel have available a cathode-ray oscilloscope and a vacuum-tube voltmeter. The voltmeter is used for checking operating voltages at the various tube electrodes, checking continuity of circuits, measuring resistance values and checking capacitors for leakage and opens. The oscilloscope affords ready analysis of deflection voltage waveforms, indicating trouble symptoms which are quickly traced to a defective part. Tubes are checked by replacing suspicious ones with new ones. Of course, maintenance technicians at Waterside apply these servicing techniques with thorough understanding of normal circuit operations and typical fault conditions.

In most cases, the well-trained technicians can determine the source of trouble in the system by a visual inspection of the monitor picture. Absence of picture and raster (blank, white-lighted screen) usually indicates loss of high voltage at the picture tube. The presence of a raster but no picture places the camera tube and video amplifiers under suspicion. Improper horizontal or vertical sweep of the picture over the face of the monitor points to trouble in the horizontal or vertical deflection circuits. A dwarfed picture probably means trouble in the low operating voltage supply. Dark areas at the picture corners can be corrected by readjustment of the magnet on the neck of the picture tube.

This brief description of ITV maintenance represents the normal extent of upkeep required. As pointed out previously, however, the simple and rugged construction of ITV components demands very little maintenance aside from cleaning. In most cases, servicing, when necessary, can economically be assigned to a recognized electronic repair organization or referred to the manufacturer.

The gage-watching system described was made by Diamond Power Specialty Corp., and the stack-watching system by Remington-Rand, Inc.

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points on the plate, the electrons are drawn in a narrow beam toward a high-positive-potential anode at the other end of the tube.

To convert electron emission from the plate into a continuing electrical current equivalent of the image, magnetic deflection coils are mounted around the tube and fed from electronic circuits. The coils so deflect the almost solid mass of electron beams that each beam, in turn, is swept across a small "scanning" hole to make its contribution to the complete picture signal. First, the beams from one horizontal line on the plate are swept across the hole; then the beams from the horizontal line just below the first; and so on, until each horizontal line of beams from the plate has been instantaneously swept across the hole. The anode behind the scanning hole adds-up the varying intensities of the beams to construct an electrical signal for the complete camera image. With constant repetition to keep up a continuing video signal, one set of coils provides horizontal beam sweep, and another effects vertical shift of the horizontal sweep.

The video signal is amplified first in the camera and again in the monitor at the end of the transmission line. The signal is then fed into a cathode-ray picture tube (right). In this tube, the picture signal is used to vary the intensity of a single point-beam of electrons which is being "gunned" at and deflected over the phosphor-coated inside face of the tube. As this varying electron beam is swept out across the inside face of the tube, it excites the phosphor which gives off light at each point in direct proportion to the intensity of the beam. Now since variations in the intensity of the beam follow those in the picture signal, corresponding to light and dark in the original camera image, the picture tube will have light and dark areas which reconstruct the camera image. Although the picture is actually a sequence of illuminated dots traced in a series of horizontal lines, the speed of the sweep will present a complete picture to the observer, whose eyes have a certain persistence of vision.

DIET FACILITIES include a trayveyor system designed to carry loaded trays from the kitchen to pantries located on each floor. The delivery point can be preselected from the kitchen.

Distribution system for new 211-bed Sinai Hospital is designed and installed with special emphasis on continuity and safety of services. Electrical work was designed by Albert Kahn and executed by Gray Electric Company of Detroit.

SERVICE CONTINUITY Emphasized in Hospital Layout

THE ELECTRICAL system for the new Sinai Hospital in the northwest section of Detroit was designed and installed in accordance with the latest recommendations for hospitals with special regard for the continuity and complete safety of the services.

Of reinforced concrete, pavilion-type construction, this general hospital is located on a 34-acre site and is the first unit of a projected medical center which will include outpatient facilities, a school of nursing and dormitory, convalescent building, physicians' building, and additional patients' wings.

Two primary services, at the 4800-volt level, enter the hospital property from two directions, originating from two separate power company substations. From the property line the 4800-volt feeders are carried overhead to cable end poles located adjacent to the transformer room. Service is extended from the end poles, underground, to two 500 kva, 4800-volt to 120/208 volt, 3-phase dry type transformers in the transformer room.

The transformers form a part of a double ended unit substation with two separated sections of secondary switchgear connected through a tie breaker and tie bus. The tie breaker is key interlocked with the main breakers to prevent closing the tie unless one of the two main breakers is open. The switchgear is composed of manually operated air circuit breakers with 50,000 interrupting capacity mains and 25,000 interrupting capacity branches.

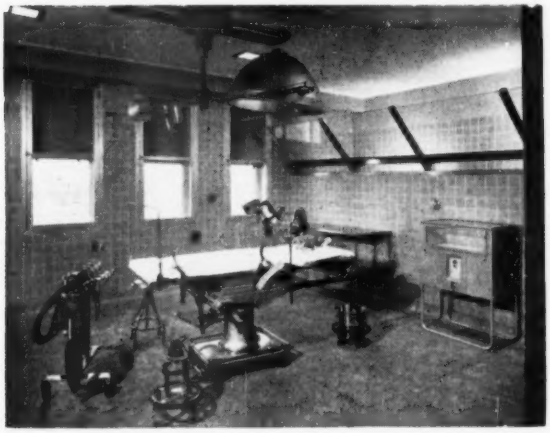
Remotely located from the main substation is an emergency switchboard which is fed by two feeders, one from each transformer secondary ahead of the main breakers, through an automatic transfer switch. The emergency switchboard is not a standby unit but is in actual service at all times, providing power for all emergency panels throughout the hospital.

From the secondary switchgear, main branch feeders are run to lighting and power distribution panels which in turn serve as branch distribution points for all lighting panels and three-phase power equipment. The number of lighting panels connected to each branch of the lighting distribution panels was held to a practical minimum in order to limit the area affected by the loss of a feeder or fuse at the distribution panel.

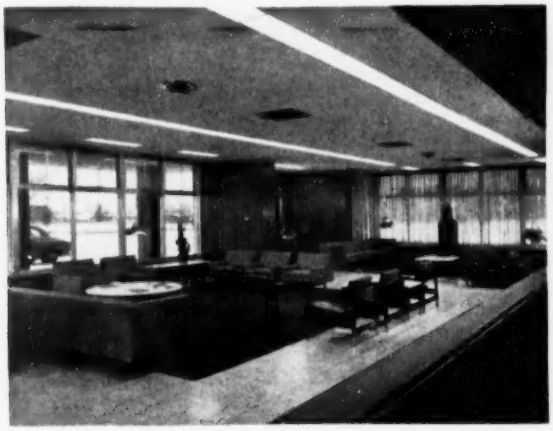
The operating section of the hospital received special treatment since all individual 120-volt circuits were required to be fed from an ungrounded system.

NURSES' STATION with some of the communication equipment, doctors light call, voice paging and nurse call annunciator. Private rooms have nurse call voice systems for direct communication.

SMALL WARDS have indirect individual bed lighting units, nurse call and handy plug receptacles, making 115-volt service readily available for hospital equipment. The outlet near the ceiling is a four hanger receptacle.



OPERATING ROOMS are served from isolating transformers with ungrounded secondaries and ground detector units. Primaries are fed from the emergency switchboard.



LOBBY LIGHTING is ingenious use of enclosed troffers with informal modern styled drop lights over tables. Flush fixtures predominate to reduce dust-collecting surfaces.

Small, dry type transformers with ungrounded 120-volt secondaries were installed local to the operating room with the area served by each transformer held to a practical minimum in order to facilitate isolating circuits which become grounded. All transformers serving the operating rooms are fed from the emergency switchboard. Ground detector units, with test buttons, are provided.

In the selection of lighting fixtures consideration was given to eliminating dust collecting surfaces. Flush incandescent units were installed in the corridors and surface mounted incandescent units in patients' rooms, while fluorescent fixtures predominate in office, clerical, lecture, general work and dining room areas.

Communication is accomplished through a basic and extensive telephone system covering, in addition to the standard requirements, all patients' rooms which are provided with telephone jack outlets. Supplementary to the telephone system, there is a doctors' light annunciator system and a voice paging system installed in corridors, lecture rooms and lounges.

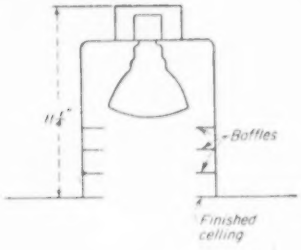
All patients' rooms contain nurses' call buttons with light indicators at the entrance door to the rooms as well as light and buzzer signal at the nurses' control station. Semi-private and private rooms are equipped with the additional feature of a nurse call voice system which permits direct voice communication between nurse and patient without the necessity of the nurse on duty leaving the central station.

In use in this building is a trayveyor system designed to carry loaded trays of food from the kitchen to pantries centrally located on each floor. The floor is selected at the kitchen loading point and delivery is made by the trayveyor to the preselected floor. In conjunction with this system, there is a complete inter-communication system enabling each floor to speak directly with kitchen.

A fire alarm station is mounted in the telephone operators' room, which is the nerve center of the building. This station is tied directly into the City Fire Protection system.

The hospital was designed by Albert Kahn Associated Architects and Engineers of Detroit, with J. J. Golub, MD, (Former Executive Vice President, Hospital for Joint Diseases, New York) as Consultant. The Gray Electric Company of Detroit was the Electrical Contractor for the project.

Manhattanville College Music Auditorium in Academic and Science Building is lighted with 32 individual Hi-hat units housing 150-watt incandescent reflector-lamps. Visible on the ceiling are the 9¼-inch diameter circular plates with 5¼-inch diameter openings.



CUSTOM LIGHTING for a Modern College

A combination of special fluorescent and incandescent fixtures installed by A. Neri, Inc., Electrical Contractors, provides illumination suited to each educational activity.

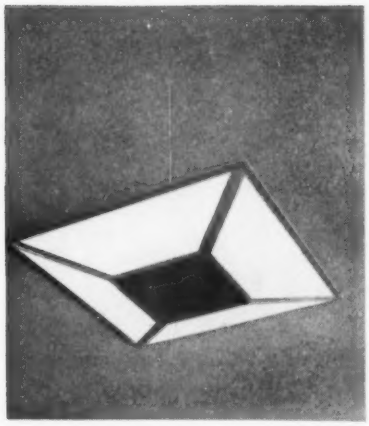
CUSTOM-BUILT and standard incandescent and fluorescent lighting fixtures combine with daylight to fulfill the many visual requirements of the five new buildings constituting the Manhattanville College for girls in Purchase, Harrison Township, New York. Gruber Lighting of Brooklyn, New York, matched its lighting know-how with the interior design of Eggers & Higgins, Architects, of New York City, and came up with the combinations pictured on these pages. The five new buildings of the college, built when the college shifted its scene of operations from Manhattan to its present site in Westchester County, are the academic and science building, library, dormitory, dining and assembly hall and a central heating plant. They are the first of a projected program of construction calling for a total expenditure of $14 million.

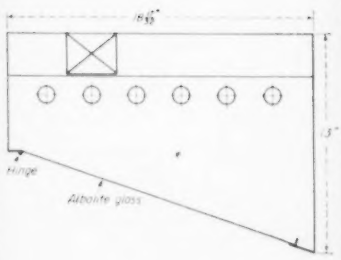
The acoustically-treated main dining room, decorated in coral and gray, is lighted by an ingenious combination fixture incorporating fluorescent lights with a square, finned ventilating outlet. The lighting portion of the fixture is made up of four sections, each containing six T-6 slimline fluorescent lamps 42 inches long and operated at 200 milli-amperes. The four banks of lamps are perpendicular to each other, forming a rectangular ring about the ventilator. Each section is covered with a rhombic-shaped diffusing sheet of Alba glass.

The same conditioning unit is combined with a special five-tube Alba glass-covered troffer built into the ceiling of the assembly hall directly above the main dining room. In addition to their utilitarian function, the 24-inch square ventilators, interspersed between four- and sixteen-foot lighting units, have a louver-like effect of breaking the long rows of T-12 lamps into smaller sections less likely to produce visual discomfort.

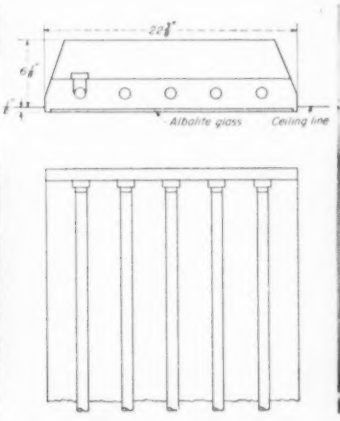
The art gallery of the academic and science building is illuminated by flush-mounted continuous row fluorescent units in a rectangular pattern incorporating directional lenses to throw light toward the gallery walls. Sculpture and pictures may be highlighted with as many as ten incandescent spots fed by outlets in a "trolley duct" built into the lighting fixtures.

The accompanying illustrations are representative of the harmony between lighting and interior design achieved by the use of these widely divergent types of fixtures to produce the utmost in eye comfort and efficiency. Electrical contractors for the installation were A. Neri, Inc., of Hoboken, N. J.

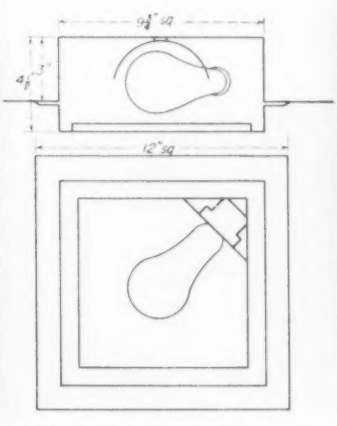


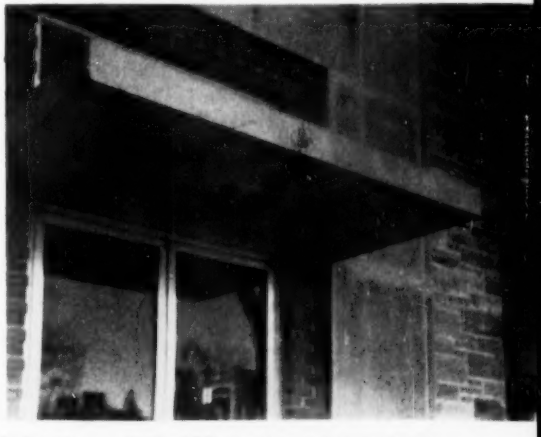


MAIN DINING ROOM is illuminated by 21 combination lighting fixtures and air diffusers measuring 61⅛ inches square and spaced on 18 ft.-6 in. centers. The 24 fluorescent lamps in each fixture total 600 watts.



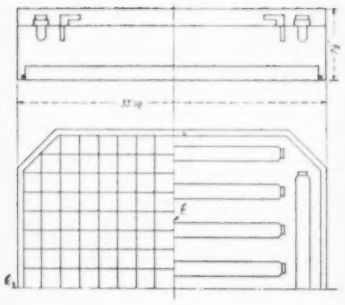
ASSEMBLY HALL special fixtures, like those of the dining room, combine 24-inch square air diffusers with lighting units. Each of seven rows on 18 ft.-6 in centers contains two four-foot and two 16-foot lighting units separated by three ventilators.



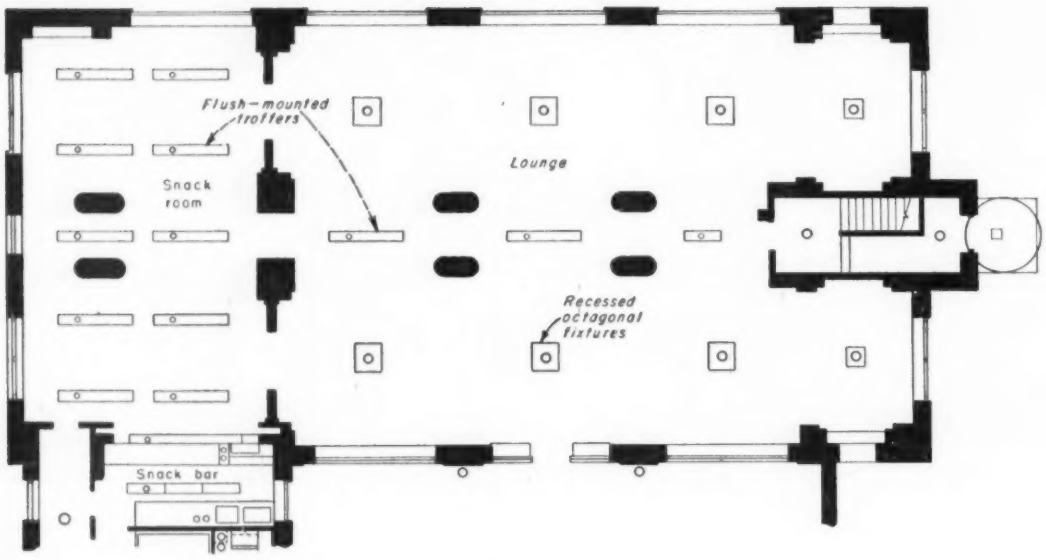


OUTDOOR ENTRANCE lighting is accomplished by shallow recessed boxes, each housing a single 150-watt incandescent lamp. Three such units are used at the entrance to the dormitory (left) and one above the library doorway (right).

LOUNGE

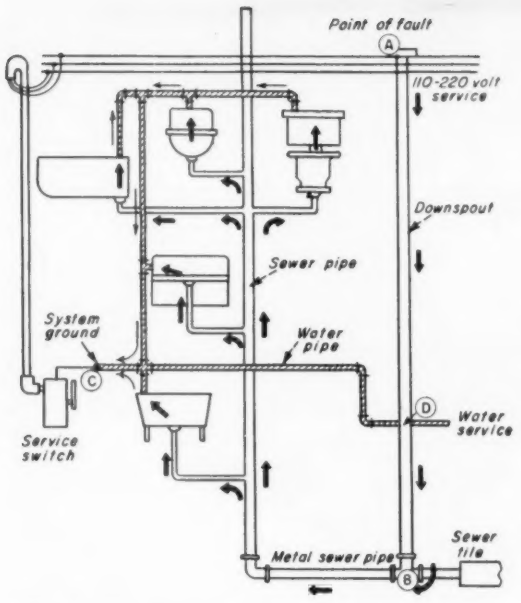


SNACK BAR



LOUNGE on first floor of dormitory building utilizes as its main source of lighting six semi-recessed octagonal-shaped fixtures 33 inches square, each containing ten louver-shielded T-12 slimline lamps. Two smaller units of similar design supplement the natural light afforded by the large windows on either side of the entrance. Standard flush-mounted troffers with Alba-Lite glass shielding illuminate the snack bar area and center aisle of lounge. Mounted to the ceiling behind electrically-operated folding doors enclosing the fountain is a continuous row of four fixtures, each containing one fluorescent lamp.

TROFFERS, as individual or continuous units flush with the ceiling, provide general illumination of low brightness and high utilization of light. Applications above include a hallway, a classroom and the sign-in desk of the dormitory building.



ARROWS SHOW PATH of fault current through plumbing fixtures when service conductor accidently grounded on rain downspout.

30% of fire losses are from unknown causes, but

Electrical Damage Without Fire

sometimes provides the clues

In this case study only a fortunate combination of circumstances averted a serious fire which may have destroyed all evidence of its cause.

By B. A. McDONALD

OF THE $224 million fire losses of 1951, approximately 30% was due to unknown causes, according to the October 1952 *Quarterly* of the National Fire Protection Association. Electricity and electrical power-consuming devices accounted for 12% of the losses of known origin, exclusive of fires caused by lightning. Whether damages due to a particular fire were included among the 30% or the 12% depended largely upon the results of trained investigators poking among the ashes and rubble of the property after the smoke had cleared and the firemen had left.

The evidence is sometimes conclusive, sometimes sketchy, often nonexistent. The occasions which contribute most to the study of electrical fires and their prevention are those in which little fire damage is done, leaving the evidence intact. Such a case occurred when one phase of a service drop grounded against the gutter downspout of a two-story frame double residence. Although the service drop came from a pole located in front of the building, it had been continued along a side wall under the eaves to the service riser at the rear of the building for possible future rear lot distribution. During a wind storm one of the single phase 115-230 volt conductors became grounded to the downspout. The point of fault is shown at A in the diagram.

Arrows indicate the path of current in the resultant 115-volt circuit to ground. Starting at A, the current followed the downspout to B, the connection to the metal sewer pipe. Immediately outside the building wall the sewer pipe was connected to a tile line which emptied into the main street sewer. The path through the tile to ground offered high resistance to the current, which traveled instead along the low-resistance circuit afforded by the drain pipes from the building plumbing appliances. The current then continued to the water supply piping by parallel paths through the bathroom water closet, wash basin and tub, the kitchen sink, and the basement laundry tubs, returning to the service line at point C, where the system was grounded to the water pipe. The paths through the plumbing appliances from drain to water pipe constituted such poor contacts that electrical arcs were established, severely burning the points of connection of drains, traps and water pipes to the fixtures. Since the house was a double residence, similar damage was incurred by the fixtures of the other occupant.

Although it is not required by the code, damage to the plumbing fixtures would have been avoided had the sewer line been bonded to the water line, such as at a point D. Since the fault occurred on a service conductor which had no over current protection other than that afforded the primary of the distribution transformer, the destructive current could have continued undetected for a considerable period of time had it taken place during the night or at a time when no one was on hand to observe it. A resident bathing at the time could have been seriously injured or electrocuted. A slight gas leak existing at the time of the fault could have provided the fuel for a serious fire. Actually the fault occurred in the late morning and was quickly detected and corrected. However, the above considerations of what might have happened suggest that only the fortunate combination of circumstances limited the damage to the plumbing and averted a fire which may have destroyed all evidence of its cause.

This is one house that didn't burn; many others did. Since electricity's 12% is higher than any other single cause of known fire losses, it behooves everyone who would point with pride to the rapid progress of the industry and the important part it plays in the development of the national economy to cooperate fully in any effort to minimize the hazards of electricity and to remove it from the ignominious position it holds with respect to losses from fire.

STORAGE SPACE for all electrical instruments should afford protection against vibration, dust, and excessive humidity.

CHECK DIRECTION of movement of meter pointer before making permanent connection to "hot" equipment.

How to Take Care of ELECTRICAL INSTRUMENTS

A practical guide to effective upkeep of electrical instruments—including proper handling procedures, correct applications and minor adjustments to insure long life and operating accuracy of all electrical instruments.

By Walter J. Prise
Chief Engineer
The Maintenance Company
New York, New York

PRACTICAL maintenance of electrical instruments depends upon a well-planned program for their handling and application. In any contractor's organization or in a plant electrical department, the program should be clearly understood and followed by all personnel who handle electrical instruments. Only by a thorough program which sets forth the rules for using electrical instruments and making necessary adjustments can long life and proper operation of instruments be assured.

Although a program for practical maintenance of electrical instruments can add much to the overall operating efficiency of any electrical organization, there are dangers which must be avoided. To attempt repair of instruments without extensive experience in such work or without the special equipment necessary for effective repair often can result in serious damage to the instruments. In any electrical organization, the limits of practical maintenance should be well-defined and understood by all concerned. Beyond these limits, repair work should be referred to a qualified instrument repair shop.

Although the details of an effective program for instrument maintenance will vary from one organization to another, every program should incorporate as much as possible the following recommendations:

Develop a training course to indoctrinate personnel in the operation and application of various types of electrical instruments. Particularly include new personnel in this program, and give prompt instruction to all personnel in the use of new types of instruments.

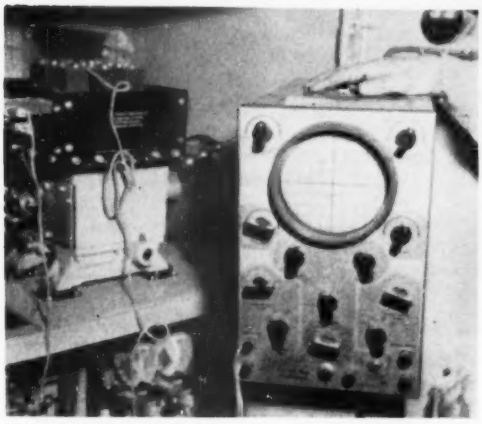
Permit only qualified personnel to handle electrical instruments. This rule may be more specific, indicating exactly what persons are qualified to handle what instruments.

Provide a written instruction sheet covering the proper care and use of each instrument. Keep these instruction sheets with the instruments, and urge frequent reference to them.

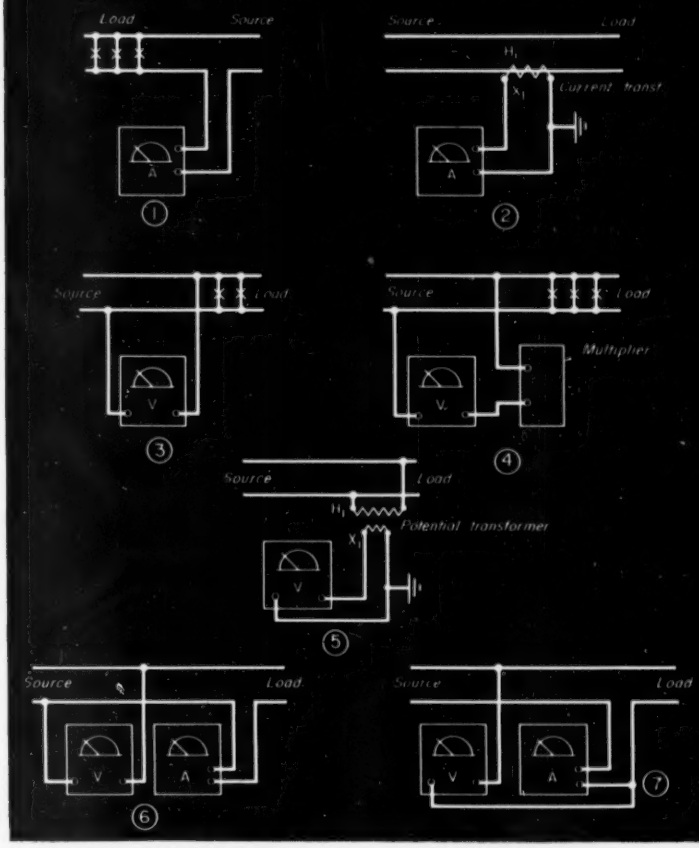
Rules of Handling

The following rules represent tried-and-tested procedures for maintaining the good condition and operating accuracy of electrical instruments. These rules should be known and understood by all personnel concerned. Enforcement of the regulations can be directed

IMPROPER HANDLING of electrical instruments can result in serious damage. Never carry more than one instrument at a time in one hand.



WIRING HOOK-UP between an instrument and a circuit under test should be neatly arranged out of the way of working personnel and moving equipment.



INSTRUMENT CONNECTIONS. 1. Ammeters should always be connected in series with load; never across it. 2. When using a current transformer with an ammeter, ground the secondary circuit. 3. Connect voltmeter across the load; never in series with it. 4. The range of a voltmeter can be extended by using a multiplier. 5. For high voltage readings, use a potential transformer with the voltmeter, with secondary circuit grounded. 6. Hook-up in which voltmeter measures line voltage, not load voltage. Ammeter measures load current only. 7. Hook-up in which voltmeter measures load voltage; ammeter measures load current plus voltmeter current.

by supervisory personnel in the organization.

1. Avoid severe shocks to instruments. Never slam covers on instruments. Meter movements, pivots and mechanical linkages in electrical instruments are sensitive elements and are easily damaged by jarring.

2. Use instruments in positions specified by instructions; in general, vertical for switchboard types and horizontal for portable units.

3. Check for freedom of movement of meter pointers before use. Check by tapping on glass cover or shifting zero. If pointer is frozen, the meter movement can be seriously damaged when current is applied.

4. Do not permanently attach leads to binding posts of an instrument until the direction of needle movement has been determined. Test for direction by touching leads to the posts.

5. Use calibrated leads and proper types of shunts when specified.

6. On multi-scale meters, always connect to the highest scale first, then reduce to lower scales as the reading allows. Use this method to determine the meter scale on which the most accurate reading can be made.

7. Always check the zero setting of a meter indicator before use. Adjust to zero by moving the external zero shifter.

8. For a particular measurement, use an instrument which will provide the expected reading between ½ and 1/3 of full scale.

9. Always tighten fastening nuts on binding posts when the posts are not in use. Fastening nuts are easily lost if not kept tight on posts.

10. Provide suitable space for storing instruments. Proper storage space should afford protection against vibration, dust, corrosive vapors and excessive humidity.

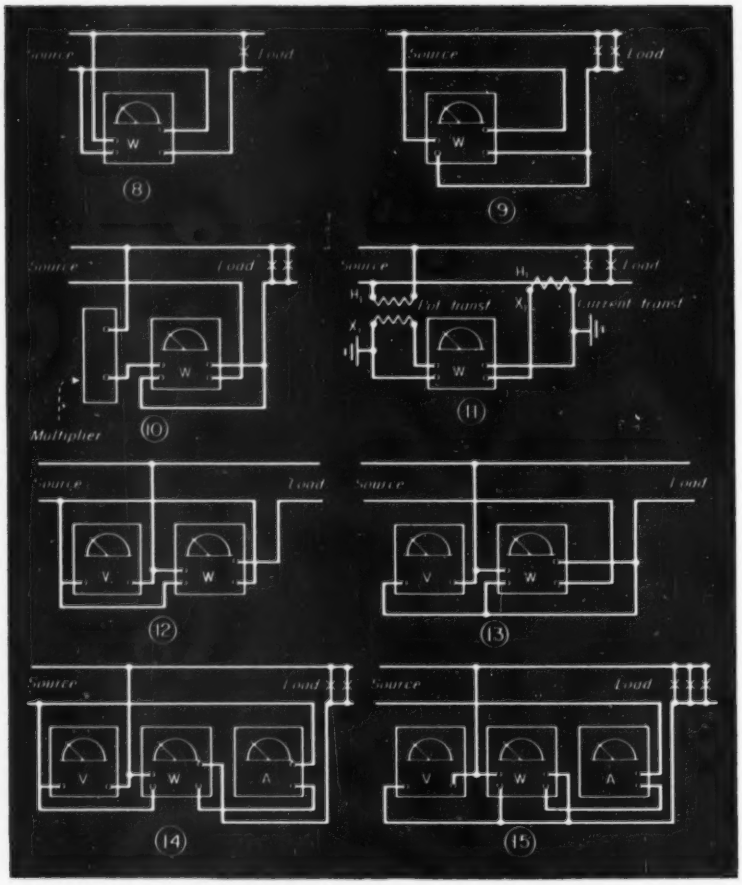
11. Never carry more than one instrument at a time in one hand. Use two hands for transporting heavy instruments which have no handles.

12. If an instrument has provision for locking the moving element, always lock the element when carrying the instrument and before placing it in storage.

13. Before using recording instruments, ascertain freedom of needle and ribbon movement.

14. Do not use instruments in strong fields unless they are designed for such application.

15. Avoid loose connections of leads to instruments and use care in arranging hook-up of leads. Do not run leads in the way of working personnel or moving machinery. Pulling on leads may result in extensive damage.



INSTRUMENT CONNECTIONS. 8. Wattmeter hook-up, measuring power in the load plus loss in wattmeter current coil. 9. Wattmeter measuring power in the load plus loss in its own potential coil. 10. Hook-up for extending the range of a wattmeter by using a multiplier (for measurements below 750 volts). 11. Extending wattmeter range for higher voltages, using current and potential transformers with secondary circuits grounded. 12. Voltmeter and wattmeter hook-up for measuring line voltage and power in load plus loss in wattmeter current coil. 13. Wattmeter measuring power in load plus losses in voltmeter and wattmeter potential circuits. 14. Hook-up of wattmeter, voltmeter and ammeter for measuring power and determining power factor in single-phase circuit. Wattmeter measures power in load plus losses in ammeter and wattmeter current coils. 15. Hook-up for measuring power and determining power factor, with wattmeter measuring power in load plus losses in voltmeter and wattmeter potential coils. Power factor is determined by dividing the wattmeter reading by the product of the ammeter and voltmeter readings.

16. Keep available a number of leads of different lengths with suitable terminals. Many different connection arrangements can then be made quickly and easily, without the inconvenience and loss of time involved in making leads as the need arises.

17. When selecting leads to use in a particular instrument hook-up, make certain that the insulation on the leads will withstand applied voltages.

18. When using multipliers, make sure they match the instrument with which they are to be used.

19. When using a current transformer, ground the secondary circuit. Never open the secondary circuit when current is flowing in the primary; a dangerously high secondary voltage will result if it is opened. Short circuit the secondary winding when changing instruments or when not in use.

20. When using a potential transformer, ground its secondary winding. Be sure that instrument is connected in secondary winding.

21. Do not mount switchboard instruments until all other work has been completed on the board.

22. If an instrument is designed for operation at normal ambient temperature, do not expose it to extremely high temperatures.

23. Use a damp cloth for cleaning glass on instruments. Dry cloth may induce a static charge on the glass.

24. Never touch the bare terminals of an instrument during operation.

25. Use special instruments when required. Special instruments are available for particular applications such as measuring starting current.

26. Provide for periodic calibration of all instruments. There are instrument repair labs which specialize in this work, keeping records and advising customers when their instruments need calibration.

Servicing

Any attempt at repair or internal servicing of instruments must be based on sound understanding of the details involved and thorough familiarity with accepted techniques for doing this work. In most cases, servicing by an accredited instrument lab is the most effective and economical procedure. In organizations with the necessary skill and facilities, however, minor repair work can be performed.

Defective operation of any electrical instrument can be traced to a mechanical or electrical fault, or both. Opens in instrument circuitry and friction in their mechanical parts are the most common faults. A careful and thorough examination of a defective instrument will usually reveal the trouble. The circuits in an instrument can be checked with an ohmmeter for continuity, using a wiring diagram of the instrument as a guide. Mechanical troubles can be found by carefully moving the various elements through their prescribed paths.

It is beyond the scope of this article to cover repair and servicing details. Such information is available in textbook form.

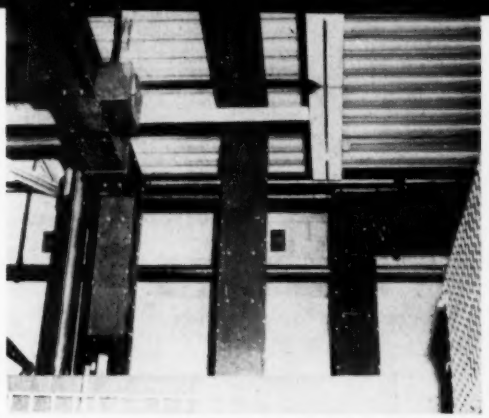
Proper Connections

One of the most important factors involved in keeping electrical instruments in top operating condition is proper hook-up. Incorrect connection of instruments to "hot" circuits or equipment is a common cause of serious damage. As part of any instrument maintenance program, personnel should be instructed in the various ways to hook-up instruments. Correct hook-ups for various meter applications are shown in accompanying illustrations. Further information on instrument connections is readily available in electrical handbooks.

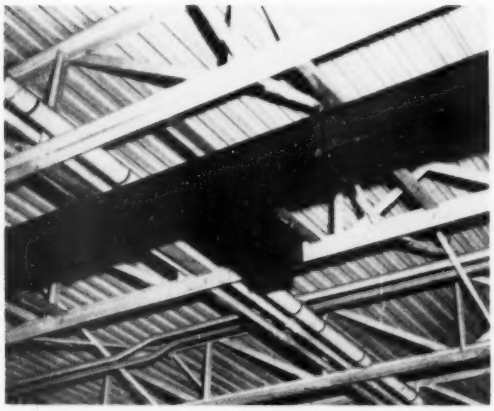
Although the information presented here is brief, it represents a broad outline for effective instrument maintenance. In any particular case, the actual details of an instrument maintenance program will depend upon the number and types of instruments.

Flexible Distribution With Feeder Bus

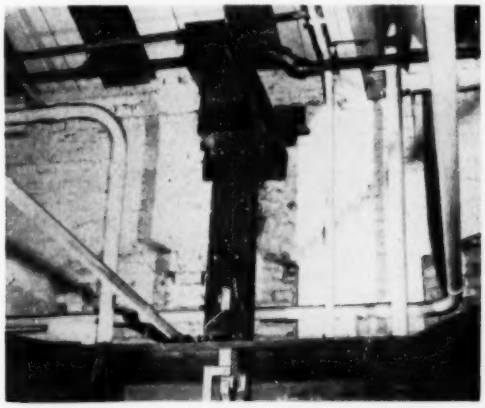
A photo-sequence of a busway distribution system serving a widespread electrical load in the plant of the Pittsburgh DuBois (Pa.) Division of Rockwell Manufacturing Company.



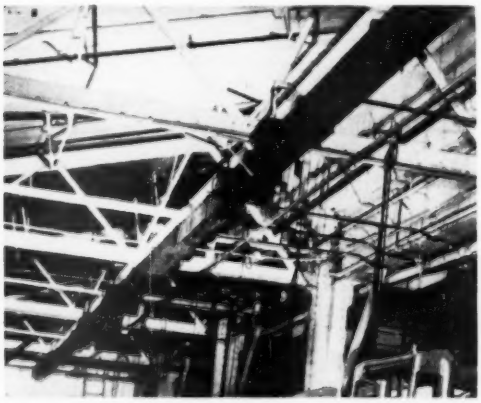
1. Feeder bus, in three runs, leads from the main distribution panel at the plant. At left, a 600-amp run serves the valve plate department through connection to plug-in busway. Center, a 1,000-amp run is tapped by two circuit breakers (one 600-amp; one 400-amp) to serve plug-in runs in tool room and grinding department and light machining department. Right, 800-amp run feeds power to compressor room.



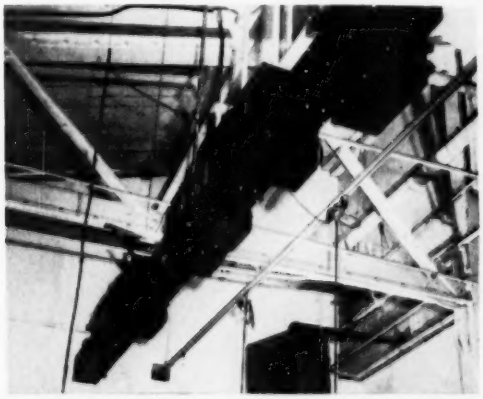
2. System expansion to meet future needs is provided for by "tees" from main feeder bus runs. Here, "tee" in main run to compressor room is directed toward bays in plant where additional machinery will be located. The busway system was installed by plant electricians who used powered industrial fork trucks to raise feeder bus lengths and to hold them in position while hangers were connected to the beams.



3. Termination point of the 125-foot run of 800-amp feeder bus from the main distribution panel is located in the plant's compressor room. Here, the horizontal run comes through the wall and is connected through the down-run to the bus bars in the power panel. As shown, the termination of the horizontal run of feeder bus is blanked-off at the junction, but can be extended in another run if necessary.



4. Plug-in busway, a 160-foot run of 600-amp size, serves the tool room in the plant, and is used elsewhere in the plant to feed machines. This type of busway permits plugging-in, disconnection or relocation of machines in the tool room production line, without shutting down the entire line when work is in progress. Several fusible disconnect plug-in devices, shown in the run above, can be located on either side.



5. Fusible disconnect plug-in devices, as well as fused safety switch plug-ins, afford flexible tapping-off of power for tools and machines. Shown above is a short section of the 600-amp plug-in run in the grinding room at the Rockwell plant. The use of this busway in conjunction with the feeder bus runs provides a simple, functional and flexible distribution system with reserve capacity to meet load growth.

MOTORIZED BENCH REAMER allows mechanic to securely position end bell for accurate alignment.

Foot-Operated
Bearing Reamer Bench

. . . assures more accuracy and quicker bearing replacements at Monarch Electric & Supply Company's repair shop in LaSalle, Illinois

INCREASED accuracy, faster operation and convenient foot control are features of a motorized bearing reamer bench designed and built in the motor repair shop of the Monarch Electric & Supply Co., LaSalle, Illinois. Prime reason for constructing the unit was to provide a means of rigidly supporting the motor end bell at right angles to the reaming tool.

The bench type unit consists of a ¼-inch steel table top welded on 2-inch angle-iron legs with supporting frame 30-inches wide, 24-inches deep and 34-inches high. A 4-inch diameter hole in the center of the table allows 7½-inches of vertical travel of the reaming tool and sufficient projection of the Jacobs chuck for above-table insertion and clamping of the reamer.

Heart of the reamer unit is a ⅞-inch, 150 rpm, double reduction electric drill under the table. The motor housing is welded to two steel side plates equipped with long steel sleeves which ride up and down on four, 1-inch diameter, vertical, steel guide rods mounted between the base frame and the underside of the table. Slotted base brackets permit rod adjustment to eliminate binding. This design permits perfect centering of the drill chuck (and reamer) under the 4-inch opening. The complete drill assembly is raised against spring tension and lowered by a full-length treadle bar with lever arm and chain pulley attachment.

To eliminate possibility of brush troubles and maintain constant speed at all times, the drill motor was rewound 3-phase 220 volt, squirrel-cage.

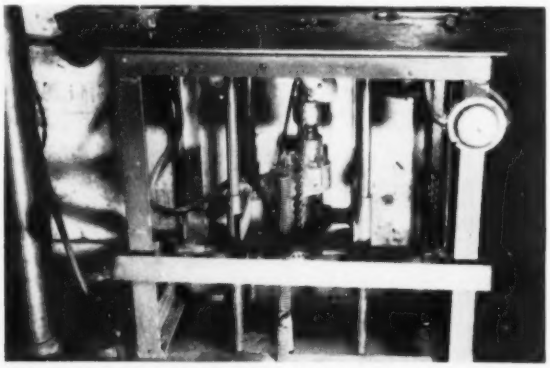
Operation of the machine is simple. The mechanic presses the foot treadle bar to the floor to raise the drill chuck above the table top for insertion of the reamer. The drill is then lowered and the motor end bell (with bearing pressed in) is placed, machined surface down, over the opening on the table. While holding the end bell with both hands, the mechanic then steps on the treadle bar and slowly raises the rotating reamer into the bearing. Normally, the rotor is on the table (in a wood rack) for convenience in trying the bearing on the shaft. If the bearing is too tight, the reamer is adjusted and the operation repeated.

Monarch mechanics like the efficiency of the unit; find that a set of 18 adjustable reamers ranging from ¼ in.-$\frac{9}{32}$ in. to 1$\frac{13}{32}$-in.-1$\frac{17}{32}$ in. takes care of all the work they do on bronze, Babbitt and other soft metal bearings.

List of Reamer Bench Parts

1—⅞" double reduction, 150 rpm electric drill with motor converted into 3-phase, 220-volt, squirrel-cage unit.
4—1 in. diameter steel guide rods with adjustable bracket feature to eliminate binding.
4—Steel guide sleeves to fit 1-in. rods.
2—Steel side plates on which motor frame is mounted.
1—Full length foot-treadle bar made of ¼" x 2" flat steel stock.
1—Foot treadle bar shaft, ¾" steel rod.
2—Pulleys and chain to lift motor.
Tension springs for motor assembly.
2-in. angle iron for table legs and frame.
1—Table top of ¼-inch sheet steel.
1—Drill switch on bench, "on-off."
1—Wood rack to hold armature.
1—Jacobs chuck wrench.
1—Wrench for adjusting reamers.
18—Adjustable reamers, range: ¼"-$\frac{9}{32}$" to 1$\frac{11}{32}$"-1$\frac{17}{32}$".

DRILL CHUCK PROJECTS through bench top for above-table adjustment or removal of reaming tools. Note rack at back for the 18 reamers normally used.

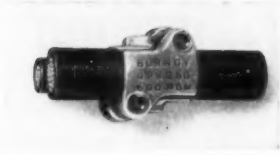


ELECTRIC DRILL ASSEMBLY under table rides up and down on four steel guide rods when treadle bar is raised or lowered. Reaming tool is always perpendicular to table top.

5 connections

END TO END

TEE



PARALLEL

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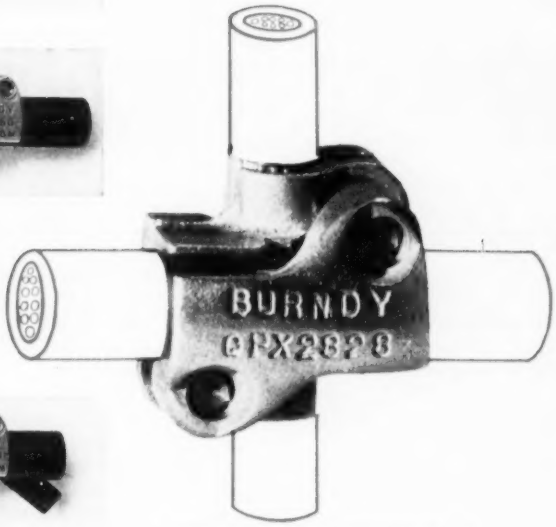

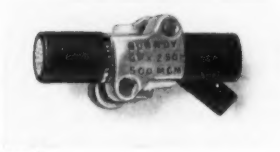

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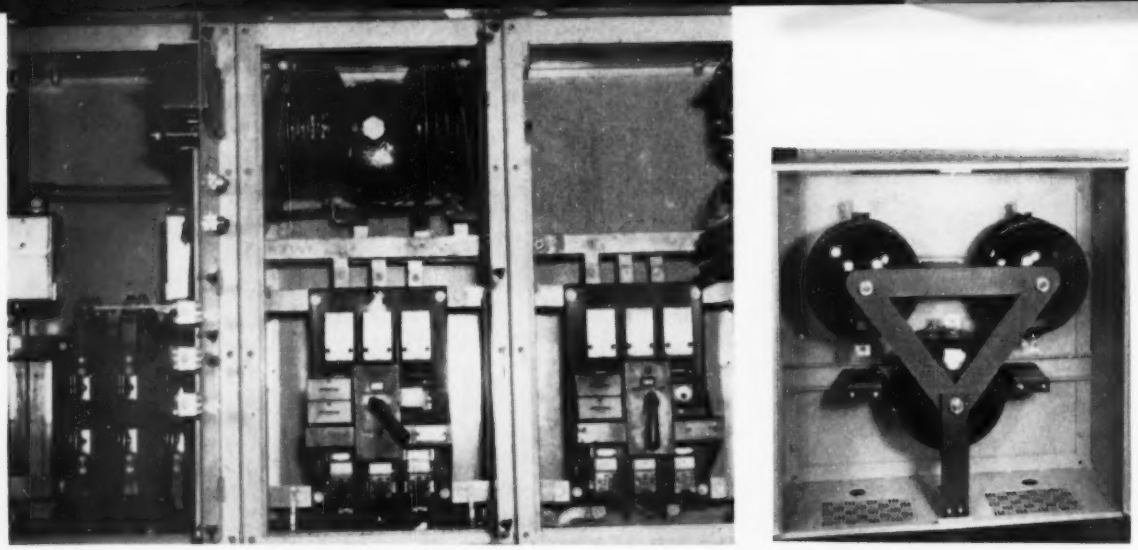

FIGURE 1. Typical reactor applications in low-voltage control centers illustrate two possible mounting variations.

Low-Voltage Current-Limiting Reactors

New self-shielded current-limiting reactor protects low-voltage industrial power systems against excess fault currents.

by J. H. Fooks
Westinghouse Electric Corp.

IN the selection of protective devices for low-voltage industrial power systems, both continuity of service and protection of personnel are important. The sizes of low-voltage power systems have grown so rapidly in recent years that in some cases the short-circuit capacity of the source of supply exceeds the interrupting capacity of standard protective devices. The maximum rms interrupting capacity of molded-frame, low-voltage circuit breakers and motor starters is 25,000 amperes. When the available short-circuit capacity of the supply bus exceeds this figure, the existence of adequate protection for individual units and the certainty of their safe operation is doubtful.

Methods of Limiting Short-Circuit Current

In such cases of high-capacity circuits extra protection should be provided for control centers to limit the maximum short-circuit current the individual circuit breakers must interrupt. Where transformers are involved, the reactance of the transformers may be used to limit the current. If this is not feasible, either current-limiting fuses or shielded current-limiting reactors can be used.

If concentrations of transformer capacities would result in excessive interrupting duty on breakers, the higher capacities can be handled effectively by distributing the load over several secondary unit substations or power center systems. The reactance of the power-center transformer limits the short-circuit current to a value within the interrupting capacity of the applied breakers.

Since the introduction of current-limiting fuses with high interrupting capacities, fuses have been used in some applications to protect control centers. However, fuses have certain objectionable features. Selective fault clearing of fuses and breakers is extremely difficult, if not impossible, because of the fixed current-time characteristics of fuses. A fuse should not clear a fault that is within the breaker rating; however, because of the tripping time of the breaker, a fuse usually blows before the breaker trips. Also, with fuse protection single phasing is possible, which is undesirable on motor drive circuits. Under partial fault conditions, fuses can be damaged so that nominal or overload current may cause them to blow, and the values at which they blow are often inconsistent. These factors, coupled with the inconvenience of replacing blown fuses, indicates that they should be selected only after careful consideration of all possible consequences of their use.

Current-limiting reactors installed in branch circuits provide the best means of limiting fault current. The alternative of applying them in the main feeder bus has several disadvantages. If the reactor impedance is sufficient to limit branch short-circuit currents to safe values, voltage regulation increases with the number of branches. Also, if the reactor is not to be replaced each time the load capacity of the feeder is increased, its normal current capacity must be sufficient to take care of the total current of the ultimate number of branches to be supplied from the main bus. Another disadvantage is that a fault on any branch would pull the voltage down equally on all other branches and would probably cause undervoltage releases to operate.

On the other hand, reactors installed in branch circuits to protect a group of small breakers permit each branch to be essentially independent of the others, and the reactor is unaffected by future changes in the load.

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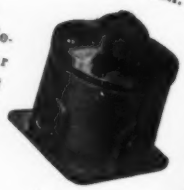

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Low-Voltage Current-Limiting Reactors

. . . *Starts on page 90*

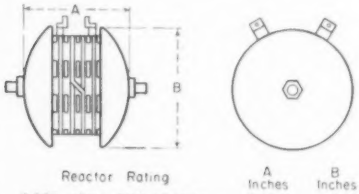
Reactor Construction

Until recently, no suitable reactors were available for use in branch circuits. Power-level current-limiting reactors are too bulky for use in low-voltage metal-clad switchgear. Also, the stray flux from the reactor field can cause trouble. Under overload and short-circuit conditions, extremely high induced currents and resultant mechanical stresses and heating can occur in the metal cell and adjacent equipment unless some method of shielding is used. Dangerous local heating and sparking from the enclosure joints, hinges and latches can also result from heavy induced short-circuit currents. These limitations have now been overcome in a new self-shielded reactor (type MSP) that utilizes Hipercrete end shields to confine the stray field and lower the winding eddy-current loss. Fig. 2 shows construction and dimensions of reactors of typical ratings.

The reactor is wound as a continuous coil of discoidal shape. Either glass-insulated copper strap or "low-loss" cable is used, depending upon the current rating. The disks, or sections, are separated by spacers of asbestos-Micarta or porcelain, and the completed coil is placed between two insulating washers having the same outside diameter as the coil. The flux shields on either end of the coil consist of mild carbon steel dished heads filled with a Hipercrete mixture of a ferromagnetic material and high early-strength hydraulic cement. The entire unit is clamped together with a high-resistance alloy stud, then thoroughly dried and impregnated with varnish.

Application

Several important factors influence the design and application of current-



Reactor Rating	A Inches	B Inches
0.025 ohm; 600 amperes	13-3/4	15
0.025 ohm; 225 amperes	8-1/2	13-1/2
0.01 ohm; 600 amperes	9	14
0.01 ohm; 225 amperes	8	10

FIGURE 2. Construction and dimensions of typical reactors.

The design of Penn-Union Multifit Connectors retains the full strength and rigidity of the silicon bronze bolt. The saddle which provides a wide surface to grip and protect the cable is permanently fastened to the U-bolt; one piece. *The strongest and most satisfactory fitting of this type.* High copper content alloy; silicon bronze Nuts and Lockwashers as well as Bolts. . . . ★ Each Multifit Connector takes a wide range of conductor sizes; only a small stock will provide for many needs. Made in a complete range for cable up to 2,000,000 cm.

The Penn-Union Line also includes numerous other types of Tees, Lugs, and Straight Connectors, as well as Service Connectors, Bus Supports, Grounding Clamps, Cable Taps, etc., etc. Experienced users have found that the Penn-Union mark on a fitting is the best guarantee of satisfactory performance.

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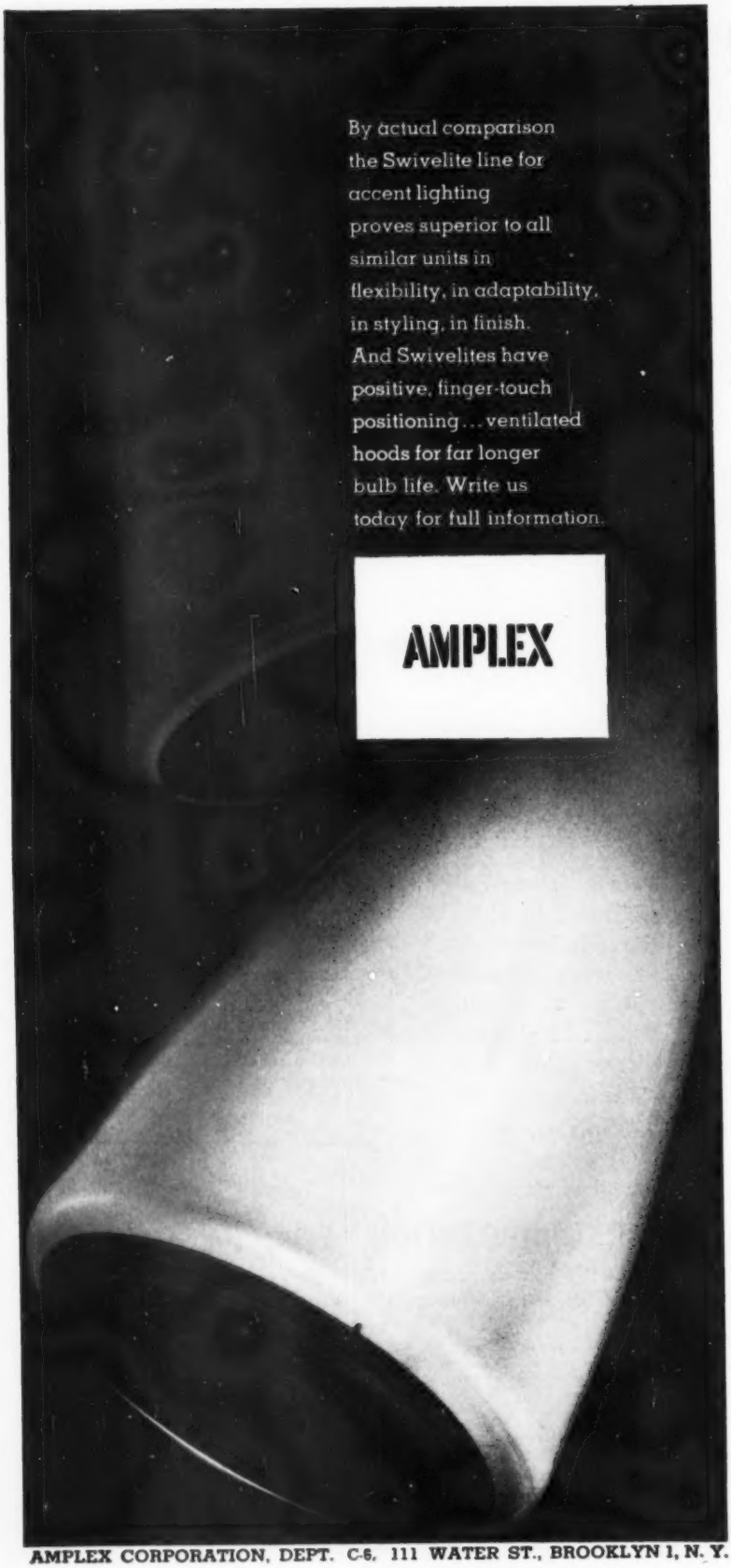

AMPLEX CORPORATION, DEPT. C-6, 111 WATER ST., BROOKLYN 1, N. Y.

Low-Voltage Current-Limiting Reactors

. . . Starts on page 90

limiting reactors for low-voltage apparatus. These include continuous and short-circuit current requirements, the effect of reactors on system operation, and the effect of other connected equipment on the operation of the reactors.

To conform with NEMA standards, self-shielded current-limiting reactors are supplied with a maximum continuous current rating of 600 amperes. The continuous current ratings of molded-frame circuit breakers dictate a minimum continuous rating of 225 amperes. Few applications require ratings above 600 amperes, although they can be furnished when necessary, and the space saved with units rated below 200 amperes does not justify their manufacture. An intermediate rating of 400 amperes is provided.

Fault current reduction requirements are adequately covered with four impedance values: 0.01, 0.015, 0.020 and 0.025 ohm, each of which covers a range of fault currents. The impedance necessary for a particular application is determined largely by the maximum interrupting capacity of the feeder circuit breakers and the available short-circuit capacity of the bus, the impedance value being chosen so as to cause the available system fault current to be reduced to a value within the interrupting capacity of the breaker. A lower limit of 15,000 amperes for the short-circuit current has been established to which reduction is desirable or practical, since a reduction from 100,000 amperes (the upper limit of interrupting capacity for standard switchgear) to less than 15,000 amperes on a 600-volt line would

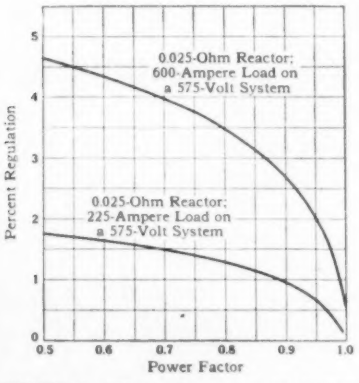

FIGURE 3. Effect of reactors on system regulation.

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They are quiet—substantially silent in operation. ✦ They can be used to full current rating on incandescent lighting loads. ✦ They can be used to full current rating on fluorescent (inductive) lighting loads. ✦ They can be used on 277 volt circuits without relays. ✦ They are totally enclosed. ✦ They can be mounted in any position. ✦ They are easy to install—designed for back or side wiring. They are available with brown or ivory handles. ✦ Their performance far exceeds new Underwriters' standards. ✦ They have many times the life of the ordinary, conventional A.C.-D.C. switch. ✦ They can be used continually up to their full rated capacity on fluorescent or incandescent loads without overheating. They will control motors with running current 80% of the switch capacity. ✦ They are for A.C. operation only.

DESIGNED FOR LONG LIFE AND QUIET OPERATION

If you would like more information about this new development, drop us a line on your letterhead. Literature will be forwarded just as soon as it is off the press.

Address Dept. M

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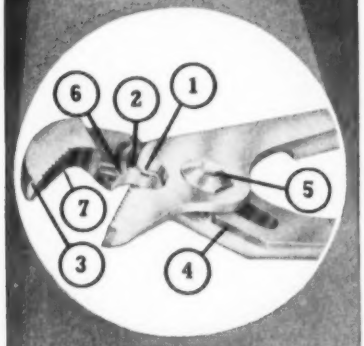
Here's the first NEW idea in plier design in years...

THE NEW No. 420

CHANNELLOCK

TRADE MARK REG. U.S. PAT. OF.

PLIER



1. Interlocking principle prevents slipping under any load. 2. New type wide base lugs cannot shear. 3. New nose design for gripping small objects. 4. Patented design of tension edge eliminates stress concentration at channels. 5. New interlocking design minimizes stress on joint bolt. 6. Precision machined interlocking surfaces result in perfect fit, distributing pressure evenly. 7. "Rite Angle" teeth guarantee maximum bite and minimum wear.

Here is a plier that will last for years! Channellock Pliers—made only by Champion DeArment Tool Co., Meadville, Pa.

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Channellock pliers are listed in the Yellow Pages of most Telephone Directories under "Tools"

THE PLIER DESIGN THAT OBSOLETES ALL OTHERS

Only CHAMPION DeARMENT makes CHANNELLOCK

CHAMPION DeARMENT TOOL CO. • MEADVILLE, PA.

Low-Voltage Current-Limiting Reactors

. . . Starts on page 90

require a reactor of ungainly size and would cause excessive system regulation. Also, the interrupting capacity of molded-frame low-voltage circuit breakers is either 15,000 or 25,000 amperes.

The effect of the reactors on system operation is manifested chiefly in system voltage regulation and lamp flicker. Voltage regulation must be considered from two standpoints: the change in voltage drop from light to full load, and the voltage dips incurred due to motor starting and irregular loads. The effect of reactors on system regulation at two different loads and various power factors, based on the largest reactor unit running at full load continuously, is shown in Fig. 3. The effects of the reactors on motor voltage and torque at starting and full-load conditions on a 230- and 575-volt system are shown in the table. Starting current was assumed to be six times full-load current at an average power factor of 0.35. A power factor of 0.85 was assumed for full-load conditions. The reduction in motor starting torque clearly places an upper limit on the motor size with which reactors can be applied. However, with reasonable care in reactor applications, no trouble due to low starting torque should be experienced on most motor circuits.

In considering lamp flicker, the change in the load is of greater concern than the magnitude of the load. Results of field tests by the Commonwealth Edison Company indicate that the allowable voltage dips should not be greater than 1% or 2% if lamp intensity variations are to be imperceptible.

The effect of other connected equipment on the choice of reactors lies chiefly in the contribution of that equipment to branch circuit faults. Induction motors, for example, act as induction generators during fault conditions, and for a 100% motor load this induction motor contribution may be as high as five times full load current.

Installation

When possible, the reactors should be given the protection of feeder breakers and should be located on the load side of the breakers.

When installing reactors, cable connections must be securely braced in the vicinity of the reactors. Forces on cable leads close to reactors may be extremely high under short-circuit conditions. Small cables, improperly braced, have actually been wrenched loose at short circuit, resulting in complete destruction of the unit.

Fig. 1 shows two arrangements typical of the installation of reactors in control centers.

Conclusion

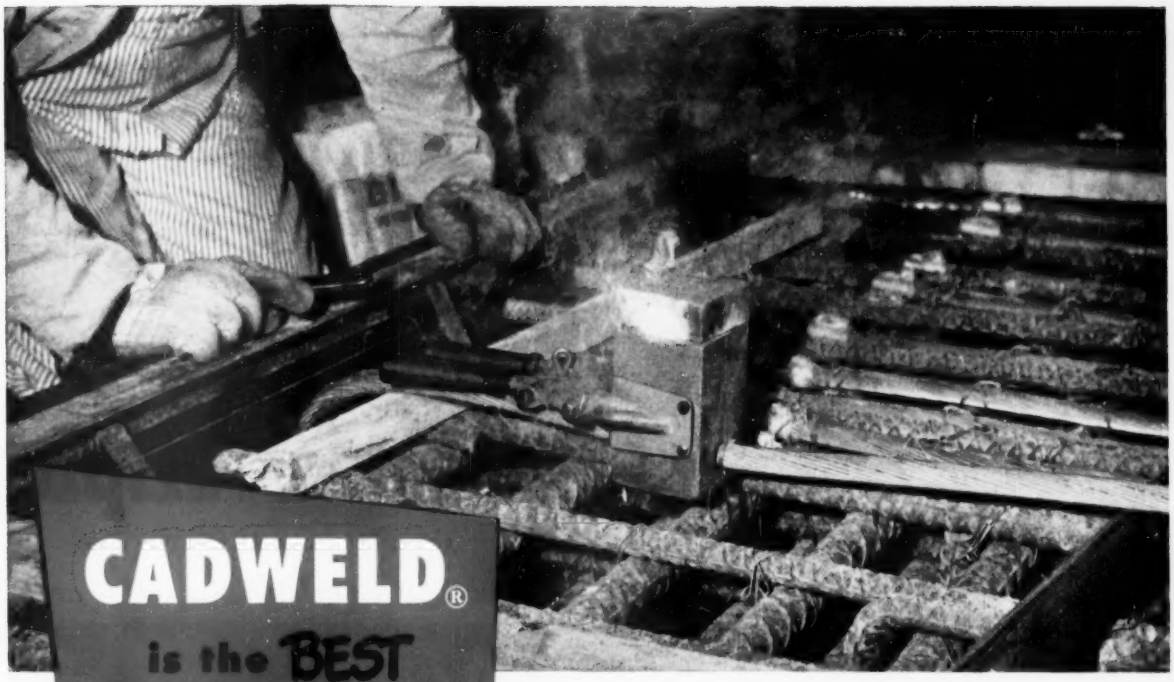
Although there are limitations to the use of individual reactors on motor drive circuits, reactors in small branch circuits serving a group of breakers adequately protect the system under all operating conditions and keep fault currents below the safe interrupting capacity of applied breakers.

EFFECT OF STANDARD REACTORS ON MOTOR VOLTAGE AND TORQUE

Motor Rating			Full-Load Conditions						Starting Conditions					
			Motor Voltage % of Line Voltage			Torque % of Full-Voltage Torque			Motor Voltage % of Line Voltage			Torque % of Full-Voltage Torque		
Supply Voltage	HP	Full Load Current Amperes	A	B	C	A	B	C	A	B	C	A	B	C
230-volt 60-cycle System 220-volt motor	50	116	99.5	99.3		99	98.6		95.1	92.7		90.4	85.9	
	100	229	99.1	98.6		98.2	97.2		90.3	85.5		81.5	73.1	
	150	340	98.6	98		97.2	96		85.6	78		73.3	60.8	
575-volt 60-cycle System 550-volt motor	50	47		99.9	99.8		99.8	99.6		98.7	98		97.4	96
	100	92		99.8	99.6		99.6	99.2		97.7	96.1		95.5	92.4
	150	136		99.7	99.5		99.4	99		96.6	94.2		93.3	88.7
	200	181		99.6	99.3		99.2	98.6		95.4	92.3		91.0	85.2

A = 0.01 ohm reactor
B = 0.015 ohm reactor
C = 0.025 ohm reactor

System $\frac{X}{R} = 11.8$



CADWELD®

is the BEST ELECTRICAL CONNECTION

Not only on the surface

For the best in grounding connections—there is only one answer—CADWELD. Regardless of whether the cables are exposed or buried in the earth or concrete, CADWELD gives you the best electrical grounding connection possible.

The solid copper CADWELD CONNECTION has 3 big advantages:

1. **It is permanent**
2. **It cannot loosen or corrode**
3. **It has a current carrying capacity greater than the cable**

In addition CADWELD is ideal for all construction work as it requires no outside source of power and the equipment is lightweight and portable.

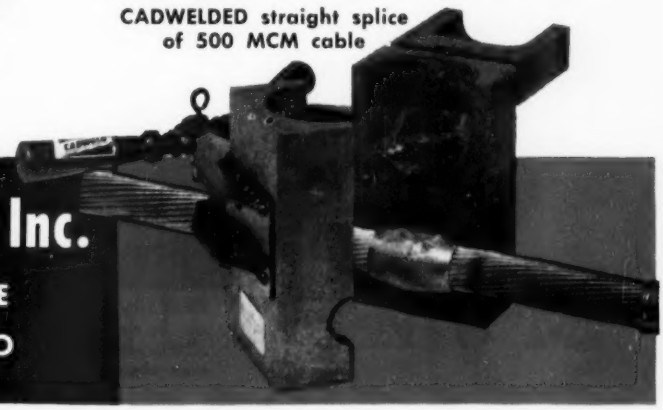
500 MCM short circuiting conductors CADWELDED around the reinforcing bars of a large concrete beam. Under the beam will run the generator leads. These cables remove the induced currents in the reinforcing bars that would otherwise produce heat and destroy the concrete.

FOR ELECTRIFYING RESULTS

CADWELD®

Electrical Catalog on request.

CADWELDED straight splice of 500 MCM cable



ERICO PRODUCTS, Inc.

2070 E. 61st PLACE

CLEVELAND 3, OHIO

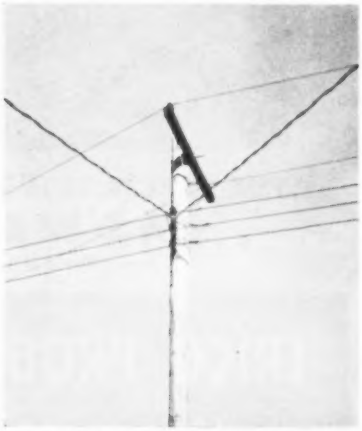
Rome Aluminum Triplex

Triplex Self-Supporting Secondary and Service Drop Cable—Regularly supplied with stranded or solid all-aluminum power conductors, insulated with RoPrene (Neoprene) and incorporating ACSR or other suitable bare neutral messenger. All-aluminum, copper or copperweld messengers are also available. RoLene (polyethylene) insulation can be supplied in place of RoPrene.

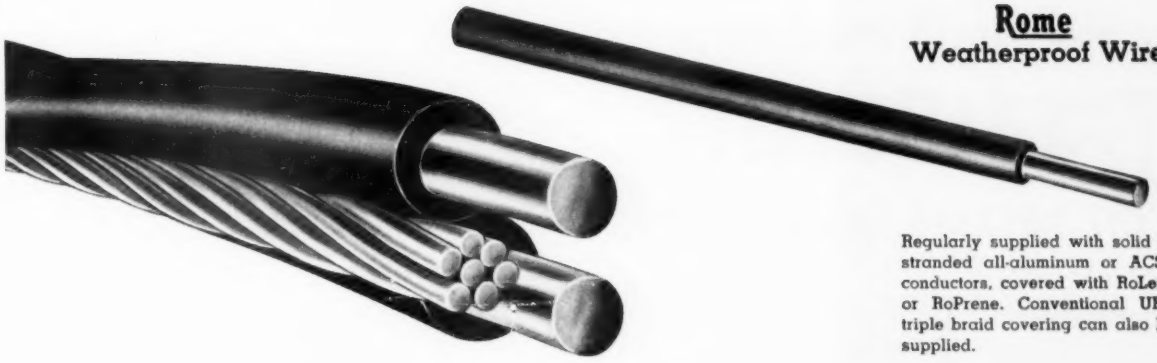
Rome Triplex Service Drop Cable provides neat, clean looking installation in new homes area.

Triplex is ideal for replacements on older houses too, particularly where eaves and roofs pose space problem.

Rome Triplex is less subject to damage by storm and falling tree limbs . . . will remain in operation SAFELY even when down.



Installation at pole and house is easy and quick, cutting costly manhours and permitting less expensive hardware.



Rome
Weatherproof Wire

Regularly supplied with solid or stranded all-aluminum or ACSR conductors, covered with RoLene or RoPrene. Conventional URC triple braid covering can also be supplied.

OFFERS YOU A HOST OF COST ADVANTAGES

Many applications of Rome Aluminum Triplex secondary and service drop cable show outstanding cost advantages over conventional bare or weatherproof open wire construction.

For one thing, by proper mechanical design it may eliminate one-third to one-half the number of poles normally required. This adds up to a substantial saving. Further, it is also possible to utilize mid-span connections for service drops.

Rome Aluminum Triplex is particularly desirable for new residential developments. It is neat in appearance while mechanical design and light weight minimize sag tendencies. This cable construction, with its strong messenger, also affords greater protection against wind and ice loading damage.

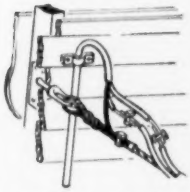
Fewer accessories are needed for secondary and service drop connections than for open wire construction. Maintenance is less costly; conductors are easily accessible.

Longer service life is assured because of mechanical design. RoPrene (Neoprene) and RoLene (polyethylene) insulation have exceptional resistance to weather and all climatic conditions. There are no braids to rot or festoon. Replacement is minimized.

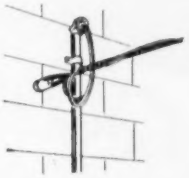
So whether it's secondary or service drop cable or weatherproof wire for distribution, Rome Aluminum offers you a host of advantages. May we send you samples?

Typical Connections

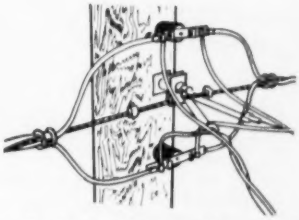
Service connection



Built-in attachment for dead-ending.



Dead end (house)



Service tap (from secondary cable)

Rome

It Costs Less to Buy the Best

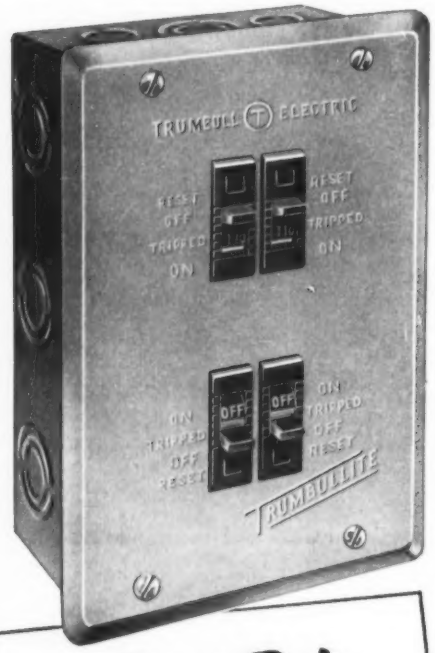
ALUMINUM

ROME CABLE CORPORATION, ROME, N.Y., AND TORRANCE, CALIF.

Three good reasons why you should standardize on

TRUMBULLITE

CIRCUIT BREAKER LOAD CENTERS



1 **Top quality construction:** Bus bars and stabs silver-plated for positive conductivity and corrosion resistance . . . breakers firmly and securely held by pressure contacts. On 12 through 20 circuit sizes bus bars are molded in plastisol . . . resist warping . . . assure long life and dependable protection . . . loads are automatically balanced as breakers are plugged in.

2 **A PLUS feature for any home:** Homeowners will appreciate its trim, modern appearance, its step-saving convenience when installed in kitchen or hall. They will like the split-second restoration of service with no fuses to replace . . . the safe, trip-free, trip-indicating action.

3 **Fast, easy installation:** Plenty of knockouts for easy top, bottom, or rear wiring. Spring-mounted free-floating interior (except 40 amp. main size) for quick alignment. Solid groundable neutral with solderless connectors, circuit numbers clearly marked.

Quick Facts

- Primarily for residential and commercial applications.
- 2 to 20 circuits, 40-100 ampere mains.
- 10, 15, 20, 30, 40 and 50 amp., 120 volt circuits.
- Famous TQL plug-in circuit breakers.
- Two-pole operation of adjacent breakers, through extension handles.
- Disconnecting means and overload protection in one device.
- No external disconnect needed with 6 circuits or less.
- Covers clearly show ON, OFF, TRIPPED and RESET positions.
- Flush, surface or raintight enclosures.
- Underwriters Laboratories listed.

LEADING ELECTRICAL DISTRIBUTORS EVERYWHERE stock and recommend Trumbullite Load Centers. See them for more information, or write us for Bulletin TEB 12A.

TRUMBULL ELECTRIC

DEPARTMENT OF GENERAL ELECTRIC COMPANY
PLAINVILLE, CONN.

Practical Methods

Removable Panels Serve Exhibit Area

WIRING DESIGN

Electrical engineers in the California State Department of Architecture faced a rather perplexing problem when they designed the distribution system for the utility buildings at the California State Fair Grounds in Sacramento. During the Fair, these buildings house various exhibits requiring localized electrical service for power and lighting needs in each booth. After the Fair is over, these same buildings are available on a rental basis as warehouse facilities for interested firms. This meant that for the major part of each year, the floor area had to be cleared of all obstacles (such as distribution panels).

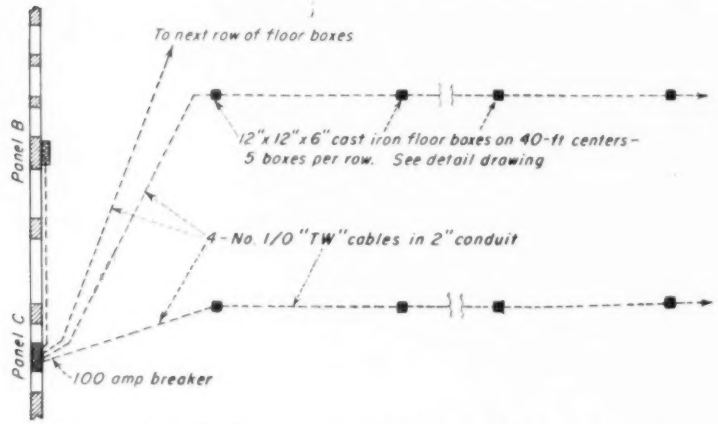
The engineers came up with a very simple and practical solution. They used underfloor feeders and small free-standing panels which can be removed and stored when the area is used as a warehouse.

Three feeders originate at a wall panel and fan out to serve a total of 15 cast-iron floor boxes (12-in. by 12-in. by 6-in.) installed flush with the concrete floor on approximately 40 foot centers. Each feeder serves a line of five boxes consists of a 2-inch conduit with four No. 1/0 type TW insulated conductors (3-phase, 4-wire, 120/208-volt system).

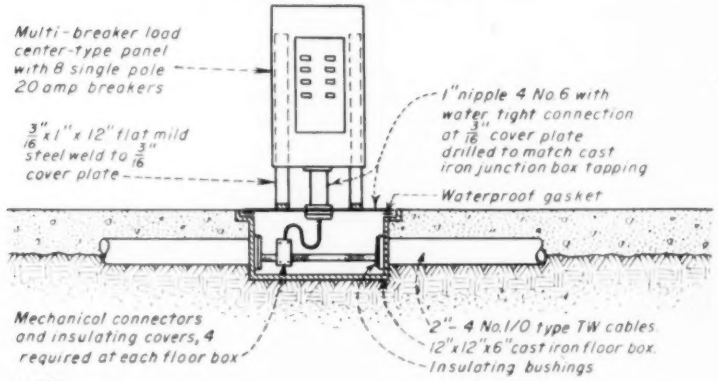
Each floor box is the base of an exhibit area service panel mounted on short steel uprights to a ¼-inch steel cover plate with waterproof gasket. Electrical connection between floor feeder and panel consists of four No. 6 conductors in a 1-inch diameter short nipple. Taps to feeder cables are made with mechanical connectors equipped with insulating covers (see drawing).

Service panels are the multi-breaker, load center type with plug-in type, 20-ampere, single-pole circuit breakers. Each panel has at least eight breakers with ample space and capacity for several additional units. New branch circuits are run each year, providing flexibility to meet changing exhibits.

When the panels are removed the insulated connectors remain on the feeder cables in the floor box. The panel base cover is replaced with the regular floor box cover (traffic type) and the area is ready for warehouse activity.


To next row of floor boxes
Panel B
12"x12"x6" cast iron floor boxes on 40-ft centers—
5 boxes per row. See detail drawing
4-No. 1/0 "TW" cables in 2" conduit
Panel C
100 amp breaker

UNDERFLOOR FEEDERS serve three parallel rows of flush cast-iron floor boxes installed on approximately 40-foot centers.


Multi-breaker load center-type panel with 8 single pole 20 amp breakers
3/16"x1"x12" flat mild steel weld to 3/16" cover plate
1" nipple 4 No.6 with water tight connection at 3/16" cover plate drilled to match cast iron junction box tapping
Waterproof gasket
Mechanical connectors and insulating covers, 4 required at each floor box
2"-4 No.1/0 type TW cables
12"x12"x6" cast iron floor box
Insulating bushings

NOTE
Regular floor box cover removed; To be installed when service panel is not in use

REMOVABLE SERVICE PANELS are mounted to steel cover plate. Feeder taps are made with insulated mechanical cable connectors. When panels are removed regular floor box cover is replaced.

Wire Thread Inserts Reduce Down Time

MAINTENANCE

Whenever machine operations are impaired by stripped or worn threaded holes, considerable time and money may be saved by inserting stainless steel helical-wire inserts. These inserts, obtained in various standard thread sizes, may be used to restore tapped threads to such items as fan bases, engine cylinder blocks, electric motor housings, pump frames and the like. Compared with time and money expended to restore a thread by other means, savings run as high as 80%, yet these inserts are highly resistant to wear, vibration, corrosion and binding, and they provide high loading strengths in all types of materials.

When restoring a worn thread, the old hole is first cleaned with a drill, then retapped. The wire thread insert is then installed with the aid of a special inserting tool. Because the inserts are slightly larger than the hole into which they are installed, the thread inserts are self locking and no amount of bolt tightening or vibration will loosen them. However, if it should become necessary to remove them for any reason at a later date, they may be taken out quickly and easily with an extraction tool.

These inserts, produced by the Heli-Coil Corporation of Danbury, Conn., are available in five standard thread

PITTSBURGH STANDARD

"THE STANDARD OF THE TRADE"

more quality conduit for America's electrical growth

More Pittsburgh Standard quality conduit will soon be on its way to our nation-wide markets, as new production facilities are being added for "the conduit standard of the trade." Pittsburgh Standard's ultra-modern new Morrisville (Pa.) Plant, adjacent to the huge Fairless Works, will mean even faster service, greater tonnage and the same guaranteed perfect conduit.

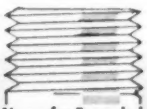
So widely accepted has been our product name, so fine its reputation, that after 50 years we have changed our company name from Enameled Metals Company to the "brand name" called for wherever quality conduit is used . . . PITTSBURGH STANDARD.

Rigid Steel Conduit and E.M.T.

Electro-Galvanized • Black Enameled
Hot Dip Galvanized • Elbows, Nipples, Couplings
Briegel E.M.T. Fittings

AGENTS IN PRINCIPAL CITIES

(Philadelphia) PLANT—1952



The New Name for Enameled Metals Co.

PITTSBURGH STANDARD CONDUIT CO.

OFFICES:
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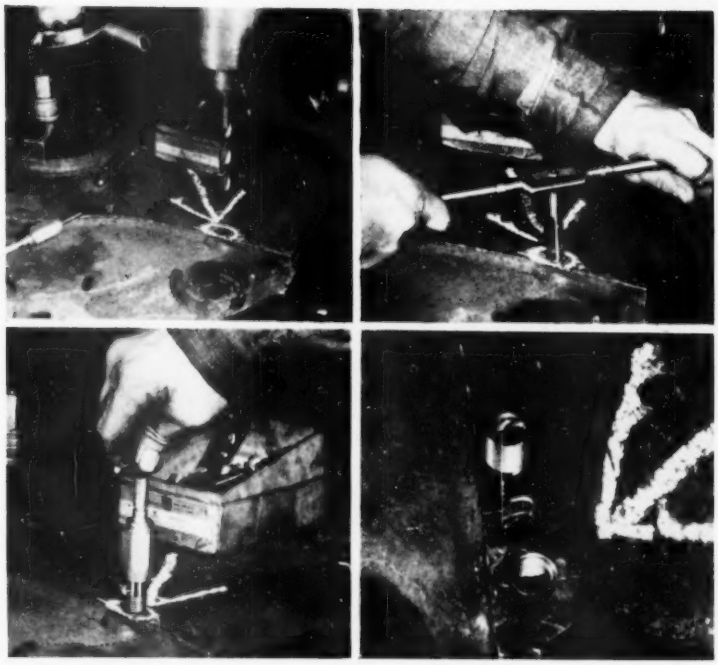
Pittsburgh, Pa.

PLANTS:
Etna, Pa.
Morrisville, Pa.



WORN THREAD is cleaned out with a drill (top left) then retapped (top right) to receive oversized wire thread insert which is inserted with special tool (lower left). The reconditioned hole (bottom right) is neat and resistant to vibration and wear. Shown on the cast surface is an unmounted insert and the tang which is removed after the insert is in place.

series (National and Unified coarse and fine, automotive and aviation spark plug, and National pipe) and are supplied in 1, 1½, 2, 2½ and 3-diameter lengths.

When compared to such conventional thread repair operations as installing oversized threads, building up the worn hole by welding or installing a solid bushing, the three-step method just described (drill, tap, insert) is instantly appreciated.

How to Cut Fine Stranded Cable

CONSTRUCTION

Repair of electric welding cables is one of the many services rendered by the T. L. Rosenberg Company, enterprising electrical construction and equipment repair firm in Oakland, California. One of the more unusual jobs encountered in the Rosenberg Shop is that of repairing the extra-flexible, stranded copper cables used as water-cooled (encased in a rubber hose) leads for assembly-line spot welders in an automobile plant.

Not all cables need to be entirely renewed. In many instances, a good portion of the lead can be salvaged and only the damaged section replaced with new copper. Normally the good portion of the lead is spliced to the new cable with connectors; the hose is renewed and terminal lugs added.

PRUNING SHEAR on bench bracket cuts extra-flexible, stranded copper cable. Tight band of friction tape compresses strands in shear jaws. V-trough supports cable.

Biggest problem, whether the lead is spliced or a new one is made, is cutting the 275MCM cable composed of some 6,916 hair-like copper strands. Hacksaw blades tend to tear the stranding and leave a frayed edge to the cut. After experimenting with several methods, Rosenberg mechanics decided to try an ordinary pruning shear. The result was even better than anticipated.

One blade of the shear is securely bolted to a bench bracket (see photo). The other blade with its handle is left free to rotate. A V-shaped trough, made of angle-iron welded to upright bench brackets, butts against the stationary blade and supports the extra-flexible cable.

CLEAN CUT by shears leaves no torn strands or frayed edge. Cut was made in center of tape band.

Secret of the whole operation is to keep the strands tightly compressed by wrapping the cable securely with friction tape at the point where the cut is to be made. The taped portion is centered in the jaws of the shear. The mechanic holds the loose cable end in one hand and pulls down the shear handle with the other. The result is a clean cut with no torn strands or frayed ends.

Photo-Cells Control Super-Highway Lighting

DESIGN

Nature's illumination intensity automatically controls operation of the new one-million dollar mercury-vapor lighting system along Edens Expressway in Cook County, Illinois. When completed, some 1,077 400-watt, 20,000-lumen luminaires will light the 14-mile stretch of 6-lane, 60 mph, dual-highway skirting Chicago's north side and suburban north shore communities. The lights go on automatically when north light drops below a one-foot-candle level; go off when the level returns to 1.5 footcandles or more.

This completely automatic and flexible control is provided by 10 photo-electric cells, one for each of ten sectionalized groups of lighting units. Each section is fed by an independently served power center. Each center includes an above-ground rectangular concrete vault housing automatic control equipment and a transformer which provides 480/240-volt power to the single-phase, 3-wire lighting circuits.

Each photo cell is mounted on a conduit mast several feet above the vault top and tilted so it faces the nor[th]

Insulating News

News of G-E electrical insulating developments that can be important to your business.

G-E VARNISHED CLOTH AND TAPES PROVIDE **MAXIMUM INSULATION AND LONG LIFE**

G-E varnished cloths and tapes were developed after years of research. Their outstanding properties result from a combination of G-E developments, such as the Glyptal® Alkyd Resins and G-E Permafil used in their treatment. With G-E varnished cloths and tapes, you can count on . . .

EXCELLENT DIELECTRIC STRENGTH that affords superior insulation for electrical equipment.

HIGH MECHANICAL STRENGTH that permits extremely tight winding and use where equipment is subjected to mechanical shock or wear.

UNUSUAL FLEXIBILITY. G-E varnished cloths and tapes can be applied easily and quickly, even when the equipment involves irregular and difficult shapes.

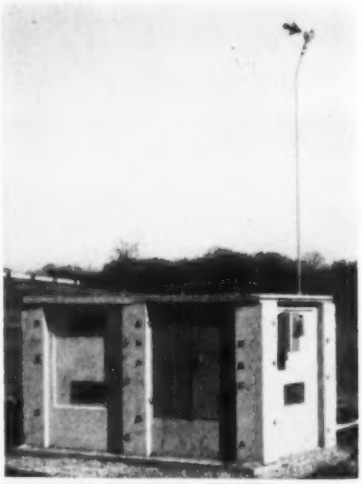
HIGH RESISTANCE. G-E Glyptal® alkyd resins, used to impregnate cloths, and G-E Permafil, used chiefly for treating glass fabrics, provide high resistance to oil, moisture, heat, and other damaging elements.

G-E varnished cloths and tapes can be used for wrapping motor coils, protecting cable joints, insulating transformers—and wherever you want maximum insulation and protection.

FOR MORE COMPLETE INFORMATION and free sample folder of G-E varnished cloths and tapes, write: General Electric Company, Section 328-3B, Chemical Division, Pittsfield, Massachusetts

You can put your confidence in—

GENERAL ELECTRIC



LIGHTING CONTROL CENTER is a concrete vault with power transformer and control equipment operated by photo cell (arrow) on conduit mast. Note how cell is tilted to face north sky.

PHOTO-CELL faces north; energizes lighting circuits when natural light drops below one footcandle level, turns them off when level reaches 1.5 footcandles.

The face of the cell will be cleaned at regular intervals during the normal rounds made by the highway lighting maintenance crews.

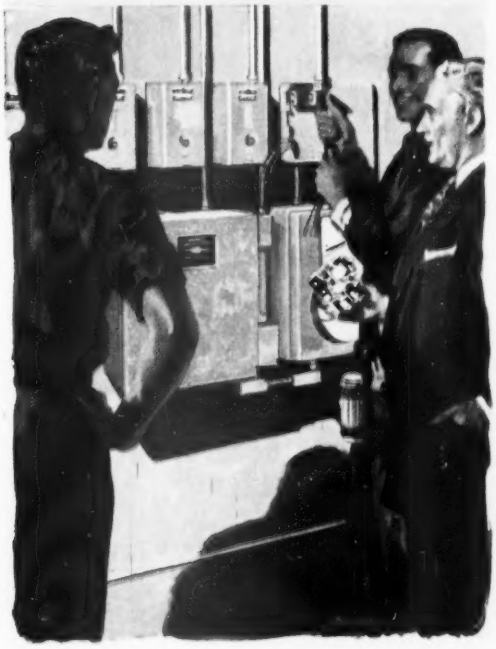
Cook County highway engineers chose this method of continuous lighting control, rather than strict time-clock operation, to insure a lighted highway whenever outdoor conditions demand roadway illumination. Should a sudden storm come up in mid-afternoon and black-out even one section of the highway, the lights in that section would go on.

THE THREE CUTLER-HAMMER STARS ★ ★ ★

STAND FOR THREE NEW STANDARDS

Installs easier

The cost of installing motor control today is usually much more than the cost of the control equipment, often two to three times as much. Thus this new control offers *large* savings.



Works better

Users say, "Nothing like this ever before." Smooth, quiet operation with uniform response. New adjustable overload protection lets motors work harder with fewer nuisance interruptions.

Lasts longer

Revises all existing ideas of long trouble-free life in motor control. Cuts rate of wear to point that maintenance care and cost are virtually eliminated for 90% of all control uses.

Look for the three silver stars on the famous Cutler-Hammer nameplate; they identify the new spectacular Cutler-Hammer ☆☆☆ Motor Control. These three stars stand for three entirely new standards in motor control satisfaction and value. ☆ 1 . . . Easier, faster, lower cost installation any electrician can readily prove. ☆ 2 . . . Time-saving, trouble-saving, cost-cutting better performance which any test will confirm. ☆ 3 . . . Amazingly longer life due to advanced engineering features anyone can understand. Compare it by features and by performance. You too will say it is the finest control you know. CUTLER-HAMMER, Inc., 1306 St. Paul Avenue, Milwaukee 1, Wisconsin.

TRY IT ! COMPARE IT ! TEST IT ! PROVE IT !

Order from your nearby Authorized Cutler-Hammer Distributor today.

CUTLER-HAMMER ★★★ MOTOR CONTROL

Now you can choose

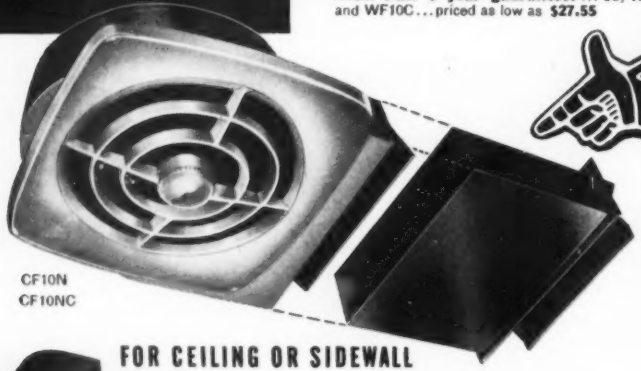
BERNS
AIR-KING
Ventilating Fans

for every purpose
—in any size
and price range

● wall switch controlled

low cost model AUTOMATIC SIDEWALL

Now available at the same price as pull chain models! Weatherproof outside hood protects against ice, snow, wind and rain—encloses scientifically counter-balanced, exclusive "Flutter-Free" shutter that automatically opens and closes when fan starts and stops. **Wall Switch controlled**—single or three speed (extra). Unscrewing of center grill knob removes grill for easy cleaning. Motor and blade completely removable by merely loosening two wing nuts. In 8-inch and 10-inch models for walls 4¼" to 28" thick. Sparkling white or chrome finish. **Full 5 year guarantee.** WF8C, WF10 and WF10C...priced as low as **$27.55**



CF10N
CF10NC

FOR CEILING OR SIDEWALL

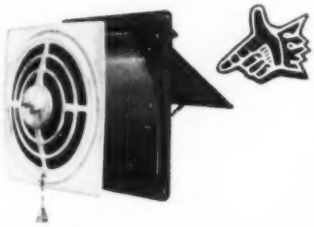
CF8C,

- **Only 3½" deep over-all**
- **Blower-type blade**

Most attractive, powerful, versatile kitchen fan available. New blower-type pressure blade maintains high air exhaust volume in long ducts. Mounts in ceiling or sidewall. Grill removes by merely unscrewing center grill knob. Outside frame will never warp or rust. Model CF8C especially recommended where low cost is a deciding factor. In White Enamel or Chrome finish. Available with 3-Speed Control switch (extra). **Full 5 year guarantee.** CF8C, CF10N and CF10NC...priced as low as **$27.95** complete with Wall Cap.

ECONOMICAL PULL CHAIN MODELS

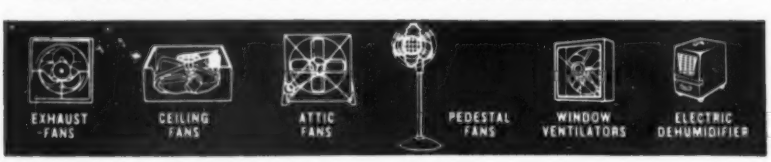
Where wall switch is not desired, this powerful, economical pull chain model is highly efficient. Eliminates wall switch installation cost. Outer frame will never rust or warp fan housing. Grill easily removed by merely unscrewing center knob. Motor mounted on one bracket—motor and blade completely removable by loosening just two wing nuts. Available in 8" and 10" models, white enamel or chrome finish for walls 5½" to 16" thick. **Full 5 year guarantee.** KF8N and KF10N ...priced as low as **$27.55**



Listed in Sweet's Catalog or ask your Wholesaler.

Complete catalog available by writing to

BERNS MFG. CORP. 3050 N. ROCKWELL ST., CHICAGO 18, ILL.



ORDERS ARE FILLED with hand cart, supermarket style, at the T. L. Rosenberg Company, prominent Oakland, California electrical contracting firm. Stock clerk pushes the easy-rolling cart through unobstructed, well lighted aisles to orderly bins in the efficiently-designed stockroom; quickly fills miscellaneous wiring material orders for small jobs.

Radio Control for Street Lighting

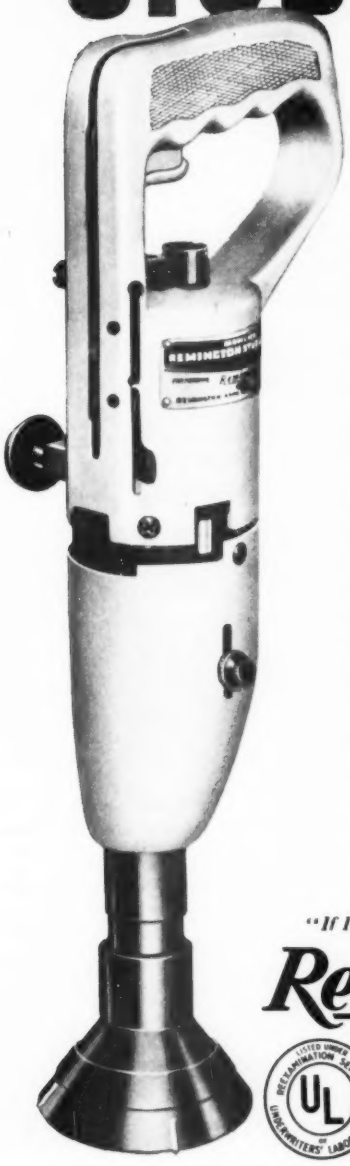
CONTROL

A revolutionary new capsule radio control for municipal street lighting systems, invented by Broadway Maintenance Corp., was installed recently on a test basis in New York City. In addition to economic advantages, this new control will provide the city with instantaneous emergency control of its

RADIO CONTROL of street lighting systems is achieved by capsule receiver (arrow) which receives transmitted radio signal and operates light. Here, unit is being mounted on top of street lighting luminaire.

Widest power range of any powder-actuated fastening tool

MODEL 450 REMINGTON STUD DRIVER



Hanging ventilating duct from concrete ceiling

Anchoring steel fittings to concrete for pipe and duct suspension

Anchoring wood sleepers to concrete

Six different 32 caliber charges meet every fastening requirement

Each of the six power loads for the Remington Stud Driver is designed to give the right power for the job—whether it's driving the stud into concrete or steel.

Long heel caps on all six cartridges mean a perfect gas seal . . . assure arrow-straight driving. Bright colors indicate the right load instantly, no chance for error. You can select the *right* cartridge for each job . . . quickly and easily.

But exceptional power range is just one of the Remington Stud Driver's many advantages. This self-powered tool sets up to 5 fastening studs per minute . . . speeds construction jobs and cuts costs. Its light weight—only 5½ pounds—makes handling easy, even in confined places.

Test proved to be the world's finest and speediest fastening system, the Model 450 Remington Stud Driver is made by the Remington Arms Company, Inc., *America's oldest sporting arms manufacturer.* Send in the coupon below for your free booklet describing the Stud Driver and its many uses.

"If It's Remington—It's Right!"

Remington

DUPONT

Listed and Approved by Underwriters' Laboratories, Inc.

--MAIL THIS COUPON TODAY

Industrial Sales Division, Dept. ECM-6
Remington Arms Company, Inc.
939 Barnum Ave., Bridgeport 2, Connecticut

Please send me my *free* copy of the new booklet showing how I can cut my fastening costs.

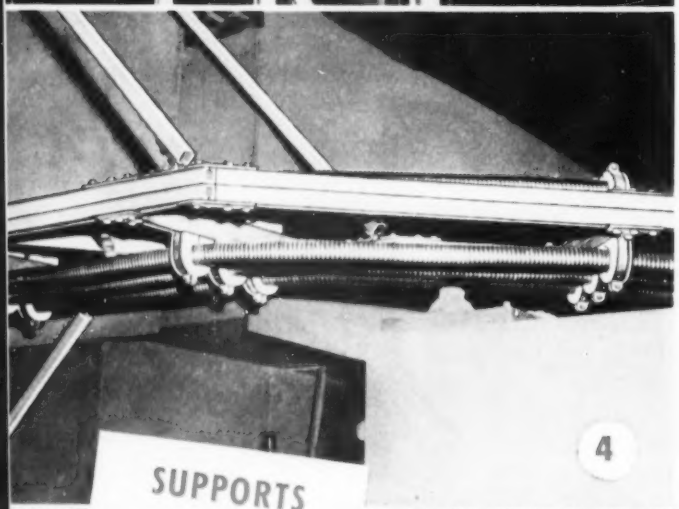
Name _____

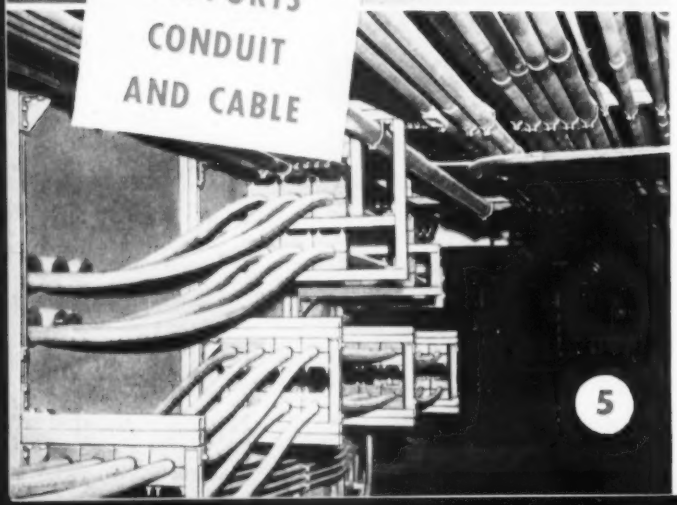
Position _____

Firm _____

Address _____

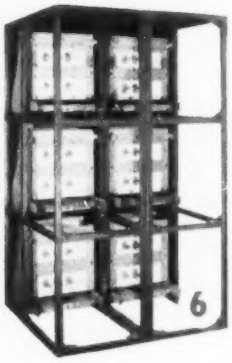
City _____ *State* _____





USE ADJUSTABLE UNISTRUT® METAL FRAMING TO MOUNT, FRAME, SUSPEND, SUPPORT ALL YOUR ELECTRICAL EQUIPMENT

quickly, easily, at low cost—
right on the job!

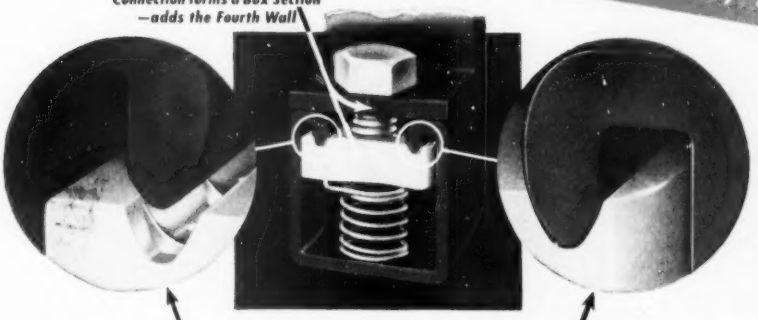


- **No welding, drilling, or punching**
- **Fast on-the-job assembly**
- **Reduces engineering detailing**
- **Eliminates errors**
- **Last minute changes easily made**
- **No waste—UNISTRUT is re-usable**

1. Showing portion of processing plant's motor control rooms with all control equipment supported by UNISTRUT channel, maple cable clamps and fittings.
2. UNISTRUT-supported fluorescent fixtures in machine shop. System provides perfect fixture alignment, added safety and better appearance.
3. UNISTRUT-supported heavy conduit run in large processing plant. UNISTRUT's extreme flexibility permits later additions or changes.
4. Bracing arrangement utilizes standard UNISTRUT channel and fittings in attaching the cable-supporting UNISTRUT framework to wall. Note porcelain insulating clamps.
5. UNISTRUT framing, porcelain and maple insulating cable clamps support cable and conduit.
6. Section of a draw-out switch cubicle completely framed with UNISTRUT channel and fittings.

This is UNISTRUT the complete framing system

Connection forms a Box Section —adds the Fourth Wall



Hardened Nut has Corrugated Grooves which bite into Inturned Edges for Positive Clamping Action

Inturned Edges can't Buckle or Spread. Nut-to-Channel Locking Action holds Side Walls in Original Position

This Pyramid Shaped Edge has ⅓ more Bearing Surface than ordinary Flat-Edged Channel and Flat-Surfaced Nut

ONLY THE UNISTRUT FRAMING SYSTEM HAS THIS POSITIVE CLAMPING ACTION AT ALL POINTS OF CONNECTION!

Distributors and Warehouse Stocks in Principal Cities. Consult your Telephone Directories.

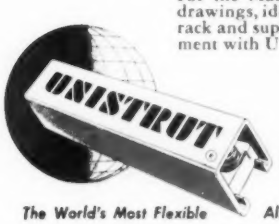
Write for NEW Free 84-page Pocket Catalog No. 800!

For the Man on the Job—packed with photos, drawings, ideas and data on how to frame, mount, rack and support electrical and mechanical equipment with UNISTRUT metal framing.

UNISTRUT Products are Bonderized

U. S. Patent Numbers
2327587 2329815 2345650
2363382 2380379 2405631
2541908 Other Patents Pending

See our complete Catalog in Sweet's 1953 Plant Engineering, Industrial Construction, and Architectural Files.



The World's Most Flexible All-Purpose Metal Framing

UNISTRUT PRODUCTS COMPANY
1013 W. Washington Blvd., Chicago 7, Ill., Dept E6

Please send me a copy of the new Catalog 800, without obligation.

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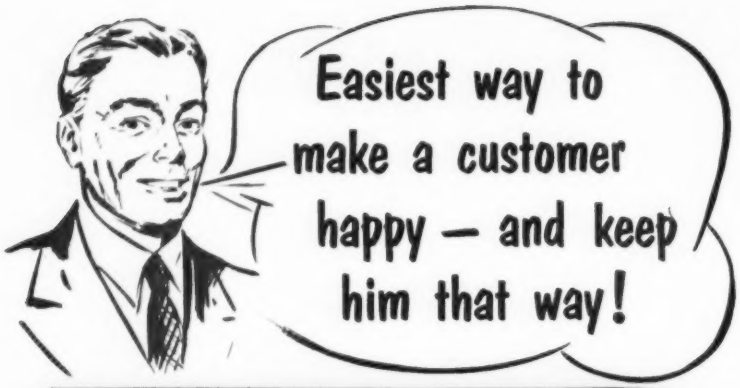
Company_____

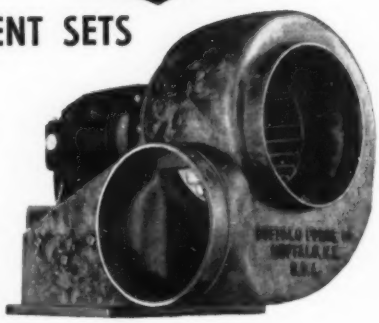
Address_____

City_____ Zone_____ State_____



Recommend the fans that are easy to live with –

"Buffalo" BABY VENT SETS



Here's a "baby" you can install quickly almost anywhere or move from place to place for 1001 blowing or exhausting jobs — ventilation of toilet rooms, telephone booths, hard-to-reach working areas. Its rugged cast iron housing is quickly adjustable to any discharge position. The efficient multiblade rotor moves a lot of air —quietly. Like all "Buffalo" Fans, it's just about maintenance-free and everlasting. One of many proven customer-pleasers in the "Buffalo" line.

"Buffalo" "E" BLOWERS

These husky blowers - exhausters are popular for furnace and forge blowing, line boosting, tool cleaning, cupola work. Often, several of these fans in an installation are preferred over one large fan for their installation economy and operating flexibility. Why not write now for the full details on these fans that are easy to sell, easy to install — and easy to live with?

First For Fans

BUFFALO FORGE COMPANY

520 BROADWAY BUFFALO, NEW YORK

PUBLISHERS OF "FAN ENGINEERING" HANDBOOK

Canadian Blower & Forge Co., Ltd., Kitchener, Ont.

Sales Representatives in all Principal Cities

PANEL BREEZO FANS · BELTED VENT SETS · BELT-AIR FANS
BREEZ-AIR ATTIC FANS · "L" BREEZO FANS · "NV" BREEZO FANS

street lights without additional equipment, if such control becomes necessary.

The new capsule radio control, approximately the size of an electric bulb, is inexpensive and disposable; it is cheaper to replace than repair. Simple in design, the basic control unit is tamper-proof and fool-proof, and cannot be "jammed" by amateur or other radio broadcasts, permitting far more efficient monitoring of daily operations.

A monitor-type receiver, the new capsule unit monitors a steady radio signal and switching assembly. It can be controlled from any standard commercial radio transmitter, providing simultaneous operation of all street lights equipped with these capsule units. The new unit has been designed to completely replace both the astronomical time clock and photo-electric cell type controls in current use.

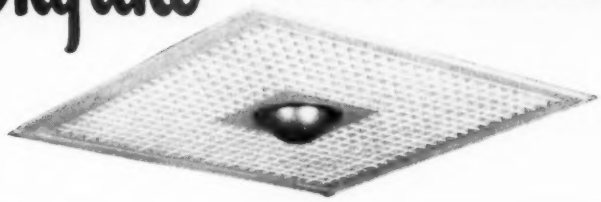
The new radio control offers split-second, willful, simultaneous operation of street lights, without regard to current interruptions, spurious lighting conditions or other occurrences which interfere with present controls. Mounted on top of each luminaire in the street lighting system, the new radio unit receives the transmitted signal which controls the operation of the light. The unit is not readily subject to pilferage or damage as a result of impacts at the pole base.

Full-scale production and installation of the units are awaiting approval of the Federal Communications Commission, required because of the use of broadcast radio signals.

MODERN CIRCUIT BREAKER lighting distribution panel is installed in existing "tub" of old style fuse and knife-switch panel as part of electrical modernization at Walker Bank Building in Salt Lake City. Wasatch Electric Company, project electrical contractors, added an extension "ring" to cabinet with a large sheet steel screw cover (flush with marble base at wall) which accommodates new panel trim. Second screw cover below panel provides for submetering equipment.

Skylike

.....THE INCANDESCENT LIGHTING SYSTEM



SELECTED by one of America's finest department stores

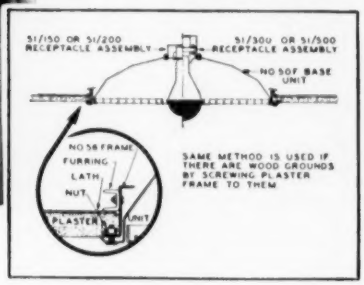
CARSON PIRIE SCOTT & CO.

for

APPEARANCE
EFFICIENCY
ECONOMY

Upper level of the new Carson Pirie Scott & Co. store at Evergreen Park, Illinois. Lighting fixtures are SKYLIKE using 500W silvered-bowl lamps

Cross section showing the simple installation method used for the SKYLIKE units



THE PROBLEM . . .

To provide a general lighting system, dignified in appearance, yet in perfect harmony with both the architectural and decorative scheme of the store. The system had to provide the color quality of filament lamps so important to general merchandising. Ceiling construction was hung wire lath, sprayed with U. S. Gypsum Sabinite. Lighting intensity required was 18 foot candles throughout the store.

THE SOLUTION . . .

Recessed SKYLIKE units using 500W. Silvered-Bowl Lamps were selected. They were centered in 10' x 18' areas and planned for in construction of the ceiling framing. Standard No. 56 plaster frames were installed when ceiling framing was built. Reflectors and louvers were installed after plastering was finished. The completed installation fulfilled all the basic requirements as to cost, quality and quantity of illumination.

Skylike . . .

The modern, versatile unit that can solve your lighting problems just as successfully as it has in countless installations in . . .

OFFICE BUILDINGS THEATRES BANKS
HOUSING DEVELOPMENTS SCHOOLS
RETAIL STORES LOBBIES SHOW ROOMS, ETC.

SKYLIKE
A SILVRAY-ASSOCIATED COMPANY

FOR COMPLETE DETAILS: A comprehensive 8-page booklet describing the SKYLIKE system and its simple installation is yours for the asking. To get your free copy, fill in and mail the coupon below.

SKYLIKE Lighting, Inc., **101 West Main St., Bound Brook, N. J.**

Gentlemen:

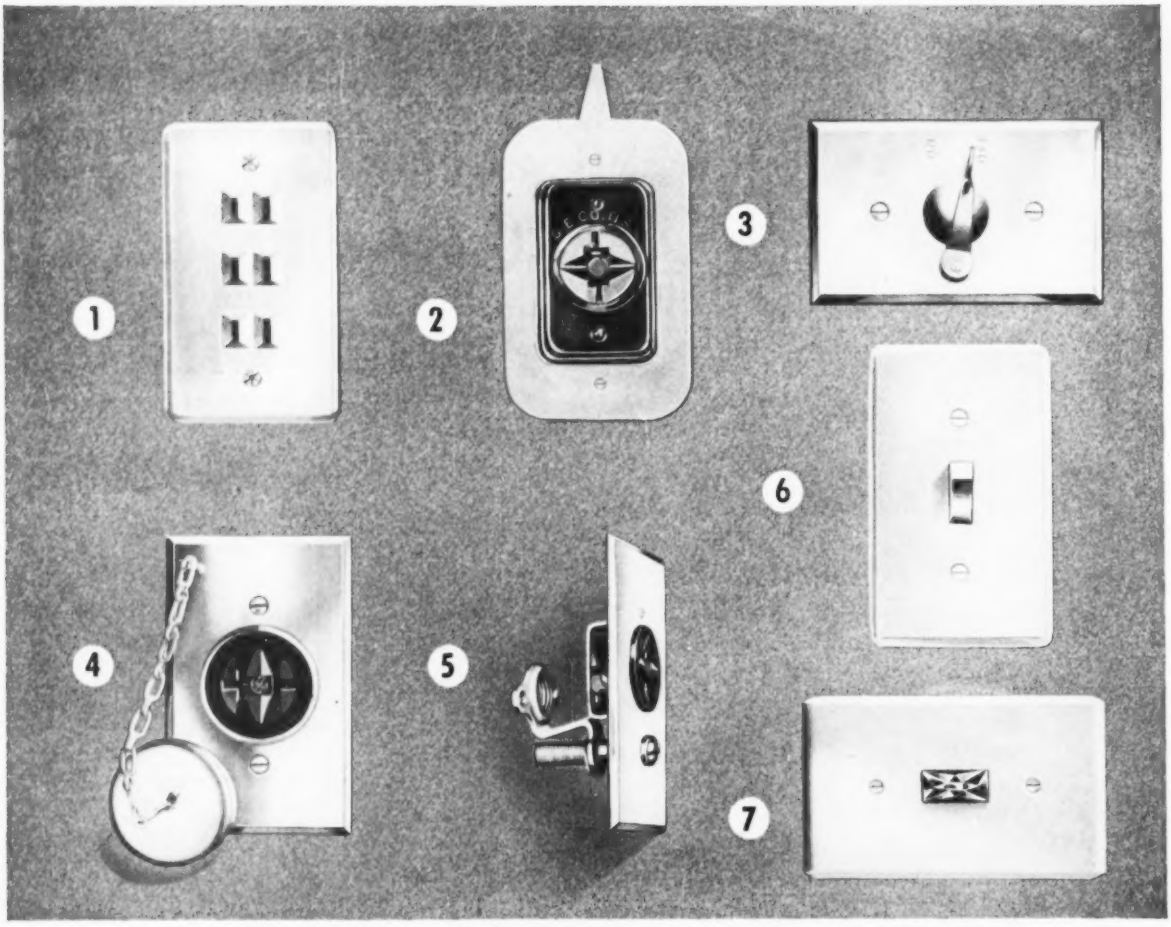
Please send me complete information on Silvray **SKYLIKE**

NAME _____

FIRM _____ TITLE _____

ADDRESS _____

CITY _____ ZONE _____ STATE _____



7 G-E WIRING DEVICES

that your customers will appreciate

Here are seven General Electric devices that give so much extra convenience for so little cost. Why not suggest them to your customers?

1879 75 1953 YEARS OF ELECTRICAL PROGRESS

1 Triple Outlet. Space-saver—three outlets in the same space as two. Ivory. Catalog No. **RO-1.** Also **RO-2** for switch control.

2 Clock Hanger—flush mounted. A neat touch for kitchen or recreation-room use. Cord and plug fit into recess, permitting clock to hang flat on wall. Catalog No. **GE2942.**

3 Weatherproof Switch. For dependable service outdoors, on porches, in garages, or other damp places. Catalog No. **GE3024.**

4 Weatherproof Outlet. Thoughtful addition to any house for modern outdoor living. Use these outlets on porches, terraces, garages, too. Catalog No. **GE2959.**

5 Fan Hanger—flush mounted. For office or home use with swivel- or trunnion-type fans. Mounts in any outlet box. Catalog No. **GE3035.**

6 Mercury Switch. Silent, durable, modern. Catalog No. **GE3008** (switch-brown), **RP071-1** (plate-brown), and **GE3088** (switch-ivory), **RP071-2** (plate-ivory).

7 Pilot-Lite. Shows when distant lights are on. Is a reminder to turn off porch, garage, or basement lights. Catalog No. **GE853** (pilot light), **GE2331** (bull's eye only), and **RP071-2** (plate-ivory).

You can put your confidence in—

GENERAL ELECTRIC

NEW PRODUCTS
CATALOGS, BULLETINS
ADVERTISEMENTS

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For further information on new products, trade literature and advertising appearing in this issue—

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ELECTRICAL CONSTRUCTION AND MAINTENANCE—A McGraw-Hill Publication

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Product News

Weatherproof Light (1)

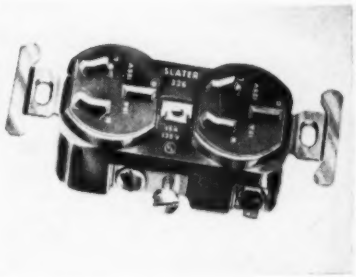
A new weatherproof light, known as "Dekorative Light", is for industrial, public and residential applications. Made of non-rusting, non-corroding Alumalloy. A weatherproof neoprene gasket seal excludes dirt and vapors. The new series includes three styles: bracket, ceiling, and pendent, in clear or frosted glass, and will take from 60 to 150-watt lamps. Available in plain Alumalloy, or steel grey finish.

Killark Electric Mfg. Co., Vandeventer & Easton Aves., St. Louis, Mo.

Electronoic Drive (2)

All-electric adjustable-speed drive of from ¾ to 3 hp, called the "V*S, Jr.," is designed to take care of a growing number of production jobs and processing operations having relatively low hp requirements. Available in five sizes—¾, 1, 1½, 2, and 3 hp ratings, a constant torque variable-horsepower drive, unit operates at speeds of from 270 to 2300 rpm, and as low as 75 rpm for setting-up operations, light loads or intermittent duty. Its components are a drive motor, operator's control station, and control unit. Drive unit is V*S motor, designed specifically for adjustable-speed service. Operator's control station, housed in a conventional NEMA No. 1 enclosure, provides "Start-Stop" buttons, a "Jog-Run" selector switch, and a speed adjustor. Control unit, mounted in a steel cabinet, may be located on a wall or column in the plant area where it is to be used, in the base of the driven machine, or in a remote location.

Reliance Electric & Engineering Co., 1088 Ivanhoe Rd., Cleveland 10, Ohio.



Receptacle (3)

A new 15 amp, 125 volt combination 3-2 wire grounding duplex receptacle. Designed to accommodate, at either end, both 3 wire tangential bladed grounding caps and conventional 2 wire parallel bladed caps. It carries Underwriters' Laboratories approval. Also adaptable to dc circuits because of its polarized parallel entrances. Construction features include a grounding terminal permanently connected to mounting strap. Grounding terminal is marked and has a green hexagonal head screw to permit code identification of grounding wire. Other features include ChannelLock terminals which lock wires. Two terminal screws on both line and neutral sides of receptacle. Available in brown or ivory.

Slater Electric & Mfg. Co., Inc., 56th St. and 37th Ave., Woodside, L. I., N. Y.

Ballasts (4)

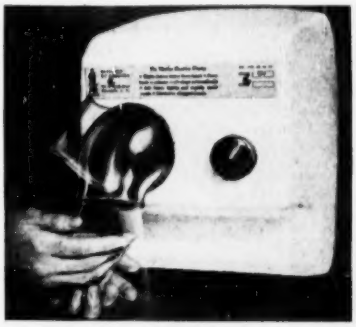
Five new models have been added to this line of rapid-start fluorescent lamp ballasts. Included are a two-lamp 72T12 ballast for the new one-ampere 100-watt rapid-start lamp, a three-lamp 48T12 ballast, and three odd voltage ballasts for two 48T12 lamps. The 72T12 and three-lamp 48T12 ballasts are specifically designed for outdoor use. They will operate lamps at temperature down to zero Fahrenheit. The one-ampere 100-watt lamp is designed for street lighting and lamp-ballast combination with increased lumen output makes it desirable for industrial, canopy, parapet, area, and other outdoor lighting installations. The three odd-voltage ballasts are designed to meet requirements of 227-, 236-, and 208-volt fluorescent lighting systems.

General Electric Company, Schenectady 5, N. Y.

Lighting Fixture (5)

A new explosion-proof industrial lighting fixture. Three mail threadings are located at each of three points: near the rim of the hood; where hood and globeholder are joined together; and where globe retaining ring and cushioning gasket are seated against globe. Two of these threadings are inside hood, the other, around the inside of globe holder. One-piece assembly of globe, holder, guard and reflector is threaded high up inside of hood to prevent leakage into lower section of fixture. All types of reflectors are available on 100, 150, 200, 300 or 500 watt fixtures. Also available for use with the new fixture are following accessories: breather, three contact receptacle, frosted globe or half-shade.

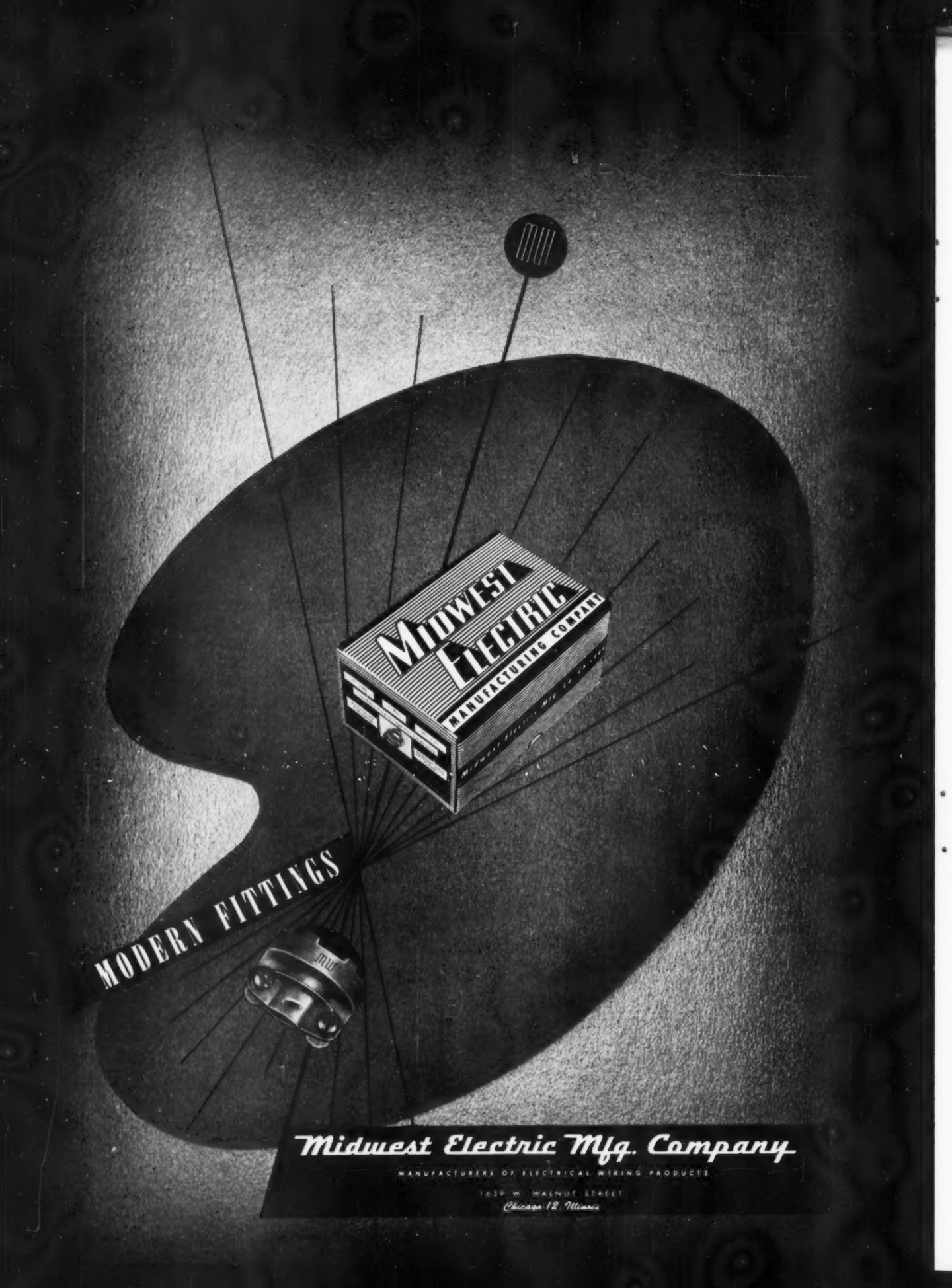
Crouse-Hinds Co., Syracuse 10, N. Y.



Electric Hand Dryer (6)

A new automatic hand dryer that combines round-the-clock deodorizing with drying. It employs a specially-developed G-E ozonating system which destroys all objectionable odors in the washroom. The Ozonaire system works constantly, converting oxygen into odor-destroying ozone. It is housed in a white porcelain and chrome cabinet. A timing device turns off motor and heating elements at end of a 30-second cycle. At 115 volts ac, the unit takes 20 amperes. Listed by Underwriters' Laboratories, Inc.

American Dryer Distributing Corp., 1324 Locust St., Philadelphia 7, Pa.


MIDWEST
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MODERN FITTINGS
Midwest Electric Mfg. Company
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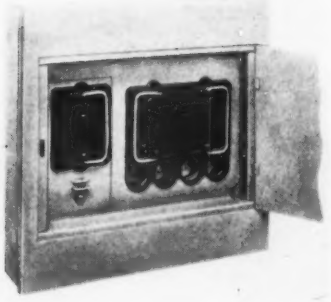
Chicago 12, Illinois

Digger (7)

A portable one-man operated digger, called the Holy-A-Minit. It digs holes ranging from 4 to 11 inches in diameter up to 6 feet deep. On Model 636S, a shaft extension is practical for digging beyond the six-foot depth. Tool can be used for digging post holes or in installing or repairing wires. It can be used in remote locations with 1 to 2 kw portable field generators, and its construction makes it practical for drilling at any angle in hard or soft earth or shale. Operate with any air drill equipped with standard Jacobs chuck or with a half-inch or larger electric drill rated at 500 rpm or less, seven amps or more.

Eugene John Freeman & Company, P. O. Box 2143, Van Nuys, Calif.



Service Equipment (8)

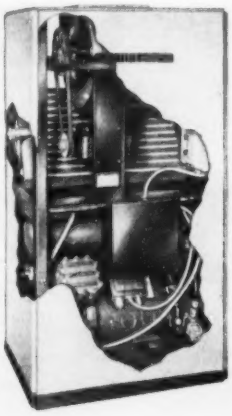
A new line of fusible service equipment with three or four pullouts and four, six or eight branch circuits. Adaptable for handling water heaters and other equipment that operate during off-peak periods. One pullout (available in 30 or 60 amps) can be isolated in a sealable compartment. Compartment barrier is removable when not required and pullout can be used for a variety of power applications. Known as PJ Series, the line is for use in residential, commercial and light industrial applications. It also has a 60 amp main connected either in series or in parallel with a 60 amp range pullout. Range pullout can be used for a water pump or a variety of other applications. A fourth pullout for 30 amp applications is also available. Units are offered with four, six or eight branch circuits.

Murray Manufacturing Corp., 1250 Atlantic Ave., Brooklyn, N. Y.

Rectifier (9)

A new tube especially designed for industrial and aviation use, and with a life warranty of 10,000 hours, has been added to this line. Designated the RCA-5690, it is a "Special Red" full-wave vacuum rectifier. It is rated to withstand a maximum peak inverse plate voltage of 1120 volts, a maximum peak plate current per plate of 375 ma, and a maximum dc output current per plate of 150 ma. It can absorb impact shocks of 500 times the force of gravity for short periods at maximum rated voltages, and withstand continuous vibration of 2.5 times the force of gravity at a frequency of approximately 25 cycles per second for hundreds of hours at maximum rated voltages.

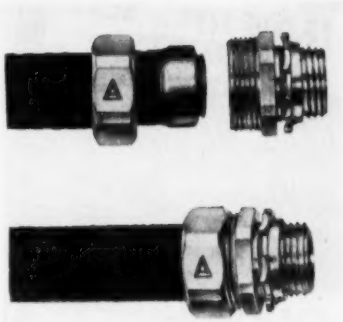
RCA Victor Division, Radio Corporation of America, Camden, N. J.



Air Conditioners (10)

A new line of Unitaire conditioners for the home. Used alone or in conjunction with a forced warm air heating system, the units will condition the average size home. A 3-hp model, called RU-31 Unitaire, stands five feet high, measures 28¼-in. wide and 21⅜-in. deep. It may be obtained with or without fan assembly, with bottom or back return air inlet and at compressor motor voltages of 208/220 volts, 60 cycle, 3 phase, or 230 volts, 60 cycle, 1 phase. Unit can be thermostatically controlled. A 5 hp model, called RU-51, is also available for homes having a heavier heat load. Measurements are slightly larger. Both RU-31 and RU-51 have a hermetically sealed motor compressor unit with a refrigerant cooled motor. Since unit absorbs its own heat, it may be located in a closet, under a stairway, or in any out-of-the-way location.

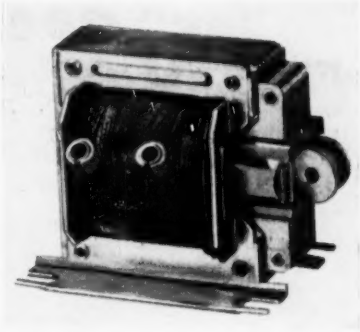
Westinghouse Electric Corp., 200 Readville St., Hyde Park, Boston 36, Mass.



Connectors (11)

New liquid-tight connectors are UL-approved for protection of electrical conductors on machinery where liquid-tight flexible conduit is used, and they are recommended where a liquid-tight flexible raceway is required. Design provides for an all-metal flaring ferrule switch, under compressing action of tightening nut, is joined securely with the flexible conduit into a liquid-tight connection. Designated as "ST" series, they assure a positive means of excluding oil, water, acid fumes, chemicals, grease and dirt from wiring system, and provide a positive ground between a flexible conduit and connectors. Available in straight, 45° and 90° connectors—conduit sizes ⅜-, ½-, ¾-, 1-, and 1¼-in.

Appleton Electric Co., 1701-59 Wellington Ave., Chicago, Ill.



Solenoid (12)

A new solenoid, featuring a replaceable coil which can be changed in the field by removing two spring clamps, is now being produced. It is known as the 2000 size C-T design and is available in two models. No. 230 delivers approximately 6.5 in. lbs. per stroke. No. 231 delivers 9.5 in. lbs. Both can be supplied for any voltage rating at 50 or 60 cycles. Dimensions are 2 1/16 by 2 by .750 inches exclusive of flanges for mounting. Coil assembly is riveted into a single piece. Field coil is moisture-proofed and can be oil-proofed, if desired. Double cotton braid lead wires are furnished, with screw or solder type terminals available when specified.

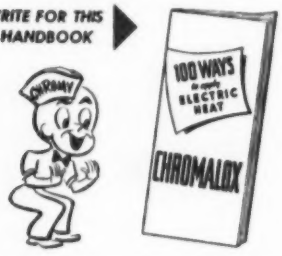
Dormeyer Industries, 3418 N. Milwaukee Ave., Chicago 41, Ill.

INCREASE PRODUCTION... DECREASE COSTS WITH THESE LOW COST PRODUCTION TOOLS

Use CHROMALOX Electric Heaters to heat liquids, air and gases. Use them to heat platens, dies, molds and moving metal parts. Use them anywhere you want fast, economical and easy-to-control heat for production line processing. CHROMALOX Heaters are simple to install, efficient, come in types, sizes and ratings for working temperatures up to 1100° F. Most are available from stock.

FOR IDEAS ON HOW TO USE CHROMALOX HEATERS

WRITE FOR THIS HANDBOOK



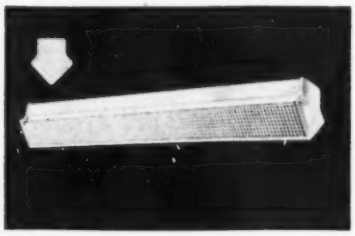
EDWIN L. WIEGAND CO., Industrial Division
7637 THOMAS BLVD., PITTSBURGH 8, PA.
Send me the illustrated booklet "100 Ways To Apply Electric Heat" 18-31-A
Name_____
Company_____
Street_____
City_____ Zone____
State_____
I use heat for_____

CHROMALOX
THE BEST IN ELECTRIC HEAT

Power Drive (13)

In the new lightweight Model-D power drive, the cast steel-iron metal housing and chuck has been replaced with aluminum. Other design changes include more convenient location of switch; lever safety-lock on switch; and, bronze spindle bearings. Unit can be used on bench, truck or with pipe legs right on the job location. Large side-openings serve for motor ventilation and hand grips for moving. Tools are stored on flat top. It has a heavy duty ½-in. to 2-in. chuck; enclosed gears running in oil and weatherproof motor.

Beaver Pipe Tools, Inc., Dana Ave., Warren, Ohio



Lighting Fixture (14)

A new corridor lighting fixture to take care of asymmetrical lighting requirements in wide halls and corridors. Sidewise illumination is very broad, and lengthwise the brightness is shielded by means of 45° by 45° plastic GrateLite louvers. Available in 4-, 8- and 16-foot lengths, wired Rapid-Start, conventional or slimline, in 1 or 2 rows of lights.

The Edwin F. Guth Co., 2615 Washington Ave., St. Louis 3, Mo.

Foot Switch (15)

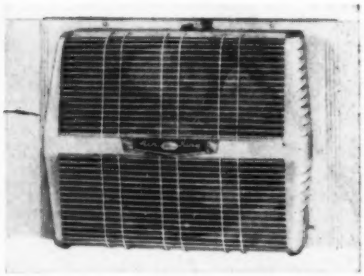
A new snap-action foot switch for starting and stopping electrically operated equipment. Foot control keeps both hands free. Install by inserting series plug on foot switch cord into wall receptacle, and plugging apparatus to be operated into series plug. Switch is specially designed to handle high inductive loads. Current rating is 15 amperes at 115 volts. Switch is housed in a metal case. Anti-skid pad on bottom grips floor to hold switch in operating position. Rubber tread on top prevents operator's foot from slipping. Overall size: 4½-in. long, 3-in. wide, 1-in. high.

Lectromatic Devices Corp. 3345 Addison St., Chicago 18, Ill.

Connectors (16)

New water-tite connectors that will fit all standard sizes of service entrance cable and many round cables. Grommets can be furnished in special sizes. Connector can also be used as a terminal fitting when going from conduit or fittings to open wiring for connecting motors, panelboard wiring and similar conditions. Aluminum alloy body insures weatherproof installations.

The Adalet Mannfacturing Co., 14300 Lorain Ave., Cleveland 11, Ohio



Window Ventilator (17)

This line of Air King manually reversible window ventilators have been restyled and are offered in single speed 10- and 12-inch models, and a 12-inch two speed model. The fan, in ivory, features a modern grill with horizontal bars which emphasizes shallowness of design. Installation of fan does not interfere with operation of windows or screens, and blade can be set to reach any part of room. Sliding side panels adjust to practically any window width.

Berns Mfg. Corp., 3050 N. Rockwell St., Chicago 18, Ill.

Installed by builders of America's LARGEST Housing Projects

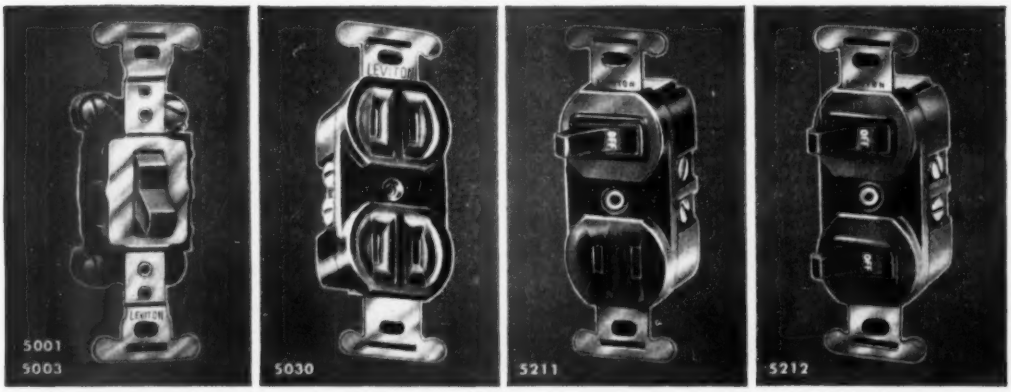
Yes, all over the country, builders of such developments as Levittown, New York, United Nations Apartments, Long Island, and John Hancock apartments, Boston, used Leviton wiring devices for good reasons.

These builders found that Leviton's "5000" line meets all government specifications — FHA, REA and others. They found that the "5000" line provided double contacts, wide plaster ears to make proper alignment faster. The staked brass binding head screws, with large heads, milled slots, and up-turned terminal lugs made wiring easier and positive. Cups made of heavy, sectioned and ribbed Bakelite assured satisfaction in heavy duty performance.

LEVITON

5000 line wiring devices

For quality's sake . . . make your next installation LEVITON!



LEVITON MANUFACTURING COMPANY

main plants and office: Brooklyn 22, New York
warehouses in: Chicago, Ill. and Los Angeles, Cal.
offices located in all principal cities

Here's Why

millions more

IDEAL Wire-Nuts®

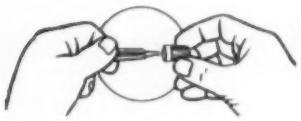
Patented, No. 1,933,555

are used than any other wire connector . . .

Because They're Safe

They twist, thread, grip and insulate all in one operation. They're pull-proof, shake-proof — make pigtail splices *actually stronger than the wires they connect*. Now, new materials and methods make "Wire-Nuts" better than ever.

. . . Easy



Just screw them on — like a nut on a bolt. Just one piece to handle — no special tools or "know-how" needed. "Wire-Nuts" practically eliminate the "human element".

. . . Fully Approved

Contractors sizes 74B and 76B are fully approved as pressure cable connectors for general use in all types of branch circuit wiring.

TRY THEM FREE

IDEAL INDUSTRIES, INC.
1041 Park Ave., Sycamore, Ill.

Please send FREE SAMPLES OF IDEAL "Wire-Nuts"

Name_____

Company_____

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City_____ Zone____ State_____

PLAY IT SAFE!

Only IDEAL makes genuine "Wire-Nuts". For your own protection look for the name IDEAL.

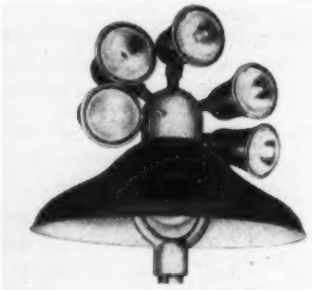
Sold Through America's Leading Distributors

Floodlight (18)

A new adjustable, vaporproof floodlight without reflectors for factories, loading platforms, storage yards, docks or warehouses. Sealed beam floodlight (Cat. No. VR300F) uses any medium base R-40 lamp. Unit adjusts to any angle. VR3000X, a companion unit, has a heat-resisting, screw type, vaporproof front lens. Junction box may be hung pendant, or ceiling mounted as an X-type fitting. Plugs are provided for unused ½-inch IPS threaded openings.

Rab Electric Manufacturing Co., 113 East 138th St., New York 51, N. Y.

(19)



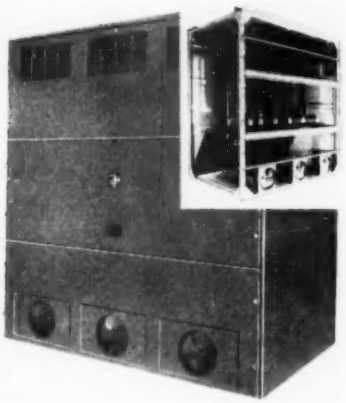
WEATHERPROOF LUMINAIRE is for service station island and other uses. It is 24 inches and can accommodate 1, 3 or 5 lamp spots. Removable side plates on both sides of socket housing makes handling easier and faster. Locking device to keep flood and spot lighting units focussed in place is optional. Manufactured by Philadelphia Electrical and Mfg. Co., 1200 N. 31st St., Philadelphia 21, Pa.

Clamp (20)

Aluminum service cable can now be put up and sagged before cable is cut with the new 7080 service wedge clamp. It permits attachment to bare neutral of twisted service drop cable at any point in

the span. Service cable can be cut to exact length. To attach, slip aluminum shell around bare neutral and insert wedge along steel rails. It grips securely, tightens automatically under load and does not depend on screw clamp. Load is distributed over long surfaces of shell and wedge to avoid damage to conductor. Stainless steel bail can be used with hooks, spools or knobs. One leg is removable for installation. It will accommodate all No. 6 and No. 4 sizes and No. 2 solid.

Reliable Electric Co., 3145 Carroll Ave., Chicago 12, Ill.



Transformer (21)

A new dual-rated dry-type heat proof insulated transformer. Blowers are mounted in the housing, and a thermostat is located in the coils. One rating covers its operation without the blowers functioning, at which time the transformer is naturally cooled. When heat reaches a certain level the thermostat activates the blowers, and this provides forced-air cooling that automatically increases the transformers rating. Baffles in housing direct the moving air over and through the coils. Air vents are located front and rear, top and bottom. Available in ratings from 100 kva to 3000 kva in voltages to 15,000 volts.

Marcus Transformer Co., Hillside, N. J.

Structural Framing (22)

A new versatile structural steel framing member called "Versabar" Channel is made from cold rolled carbon steel in four basic sizes. Channels can also be furnished in many different combinations to suit specific requirements. Standard finishes are plain, green enamel or galvanized. Versabar serrated nuts are specifically designed for use with channels. Some of the applications for which a wide range of connecting fittings are available include—bus bar supports and hangers, cable supports, fluorescent fixture supports, lighting system supports, conduit supports, switchgear frames, etc.

M-H Standard Company, 515 Communipaw Ave., Jersey City 4, N. J.

IDEAL

WIRE STRIPPERS

Save Minutes and Money ON EVERY STRIPPING JOB

Stripmaster®

Patented, No. 2,523,936

with Exclusive "ONE-SQUEEZE" Action for 2-second Stripping of Lighter Gauge Wire . . . Handles Heavier Gauges, Too

A light squeeze on the handles strips wire up to a full 7/8" clean and bare. Comfortable grip fits small hand, tool weighs only 10 oz. Exclusive automatic lock holds jaws open after stripping until wire is removed, prevents crushing stranded wire. Won't nick or score wire. Cutter ends are shielded for complete safety. Specially hardened stripping blades may be easily replaced or interchanged.

SIX MODELS for all wire sizes from No. 8 to No. 22. Also for POSJ.

Sold Through America's Leading Distributors

RUGGED, ALL-STEEL

"E-Z Automatic" Model

For Heavy Duty Stripping

Works like pliers, to make tough stripping jobs fast and easy. Powerful leverage enables you to easily cut through tough insulation and then strip wire bare. Automatic stop locks blades and jaws, preventing back-snap against wire ends. Cannot crush stranded wire or accidentally nick or score wire. Cutter edges shielded to safeguard hands. Can also be used as a *wire cutter.*

Specially hardened blades are replaceable. Models for all wire sizes from No. 10 to No. 26, also for POSJ, 300 ohm TV Downlead and non-metallic plastic sheathed cable.

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IDEAL INDUSTRIES, Inc.

1041 Park Avenue, Sycamore, Illinois

Please send me catalog data on "Stripmaster" and "E-Z Automatic" Wire Strippers.

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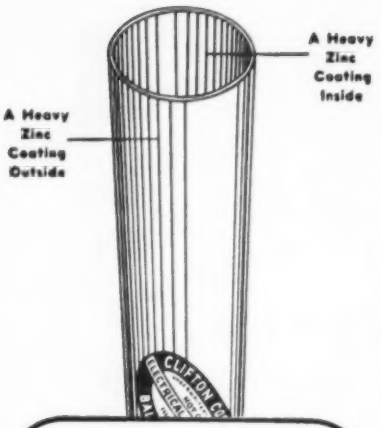


CLIFTON E.M.T.

gives you

DOUBLE THE ZINC PROTECTION

of ordinary E.M.T.

Because of this extra protection, you can often substitute CLIFTON E.M.T. for rigid conduit—and make substantial savings. Wherever electrical metallic tubing is acceptable for outside installations, CLIFTON E.M.T. can be used with complete confidence.

Hot-Dipped Galvanized

CLIFTON E.M.T. is hot-dipped galvanized by a special process which deposits a uniformly heavy coating of zinc inside as well as outside the tubing, and bonds the coating to the steel tubing. Will not flake or chip.

OTHER CLIFTON PRODUCTS include Rigid Conduit, Flexible Steel Conduit, Armored Cable and Pierceway Plastic Duct Wiring Systems.

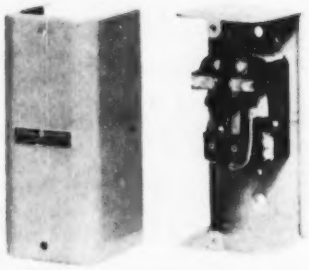
Listed by Underwriters Laboratories, Inc.

WE MAKE NO BONES ABOUT IT . . .

CLIFTON PRODUCTS ARE THE BEST IN THEIR FIELD

CLIFTON CONDUIT CO., Inc.

General Offices
75 Montgomery St.
Jersey City 2, N. J.
Factory: Baltimore, Md.



Relays (23)

A new line of general purpose relays, featuring longer life and greater flexibility of application. Operating life has been extended by use of a braided shunt and repositioning of shunt to reduce tension and wear. Conversion units are available for metal and compound base back mounting, base receptacle and relay jack-plug applications and explosion-proof enclosures for dust tight and Class 1, Group D service. Designated as CR2790-E, they are rated from 6 to 300 volts; 60, 50 and 25 cycles plus dc; and 10 amp continuous contact rating. Contact arrangements include—double-pole single-throw, double-pole double-throw, and single-throw double-break. Relays may be used as starters for small ac motors where motors have sufficient overload protection. They also are suitable for application in electronic equipment and air conditioners, where small space and long relay life are major factors.

General Electric Co., Schenectady 5, N. Y.

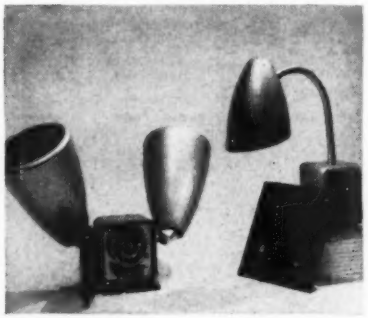
(24)

MOUNTING TROUGH which accommodates any number of lampholders up to 10. It is weatherproof and has removable front plate. Locking device, which keeps flood and spot lights in position, is optional. Manufactured by Philadelphia Electrical and Mfg. Co., 1200 W. 31st St., Philadelphia 21, Pa.

Electrical Tape (25)

New splicing plastic tape for all electrical applications. It will resist weather, corrosive chemicals, water, oils and abrasion. It is extra thin with high tensile strength, high adhesive qualities, and conforms to irregular surfaces. Its dielectric strength averages over 1000 volts per mil of thickness, meeting the Underwriters' Laboratories' specifications, the U. S. Government's and standards of ASTM. Tape comes in 60 and 20 foot rolls in ¾ inch widths, and in a 12½ foot roll with a ½ inch width.

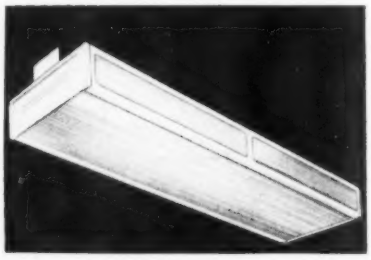
Boston Woven Hose & Rubber Co., P. O. Box 1071, Boston 3, Mass.



Display Lights (26)

New automatic On-Off display lights feature built-in time switch which turns the unit on and off. Units permit universal adjustability, for lighting can be altered to suit the display. Lights may be focused in any direction, and may either be placed on floor or counter, or hung on a wall, pillar, or display background. To use, set the time-dial for operation any time during the day or night. The extra outlet feature enables the connecting of either ditto units, or present display lights, to the automatic master unit to increase illumination up to 1650 watts. Motion displays and other electrical devices can be controlled by master unit. Time spots are in models having either one, two or three Torpedo spots, using 100 to 200 watt bulbs. Time lights are equipped with flexible arm and hood combinations instead of spots, and use 75 to 100 watt bulbs.

Tork Clock Co., Inc., Mount Vernon, N. Y.



Fluorescent Fixture (27)

A new fluorescent fixture, called Peer-Lite, is designed to blend with contemporary interiors. Flexibility permits the use of a wide range of louvers and diffusers. Available with eggcrate, Albalite, Flutex, Optilux and prism lens bottoms, or with GrateLite, plastic, lattice-like louver-diffuser. Available with two, three or four lamps; four or eight feet long.

The Edwin F. Guth Lighting Co., 2615 Washington Ave., St. Louis 3, Mo.

Lady of Lourdes Hospital, Camden, New Jersey

IN HOSPITALS, TOO, IT'S *"Talk-Don't Walk"*

MODERN ARCHITECTURE—
MODERN INTER-COM SYSTEMS

Modern buildings of all types are wired for inter-com sound systems. Efficiency demands "Talk—Don't Walk."

The beautiful new Lady of Lourdes Hospital at Camden, New Jersey, has taken advantage of the permanence and trouble-free performance of Belden Inter-Com Cables for its built-in systems. Specifically, Belden No. 8743 is used for its under-pillow radio receivers.

There is a specialized Belden Cable for every inter-com or sound system requirement.

Belden Manufacturing Co., 4623-A W. Van Buren St., Chicago 44, Ill.

"Talk-Don't Walk"

For *Permanent* Installations

For Profitable Work

FOR EVERY TYPE OF INSTALLATION
FOR EVERY TYPE OF EQUIPMENT
BELDEN HAS THE CABLE BUILT TO
MANUFACTURERS' SPECIFICATIONS

Belden
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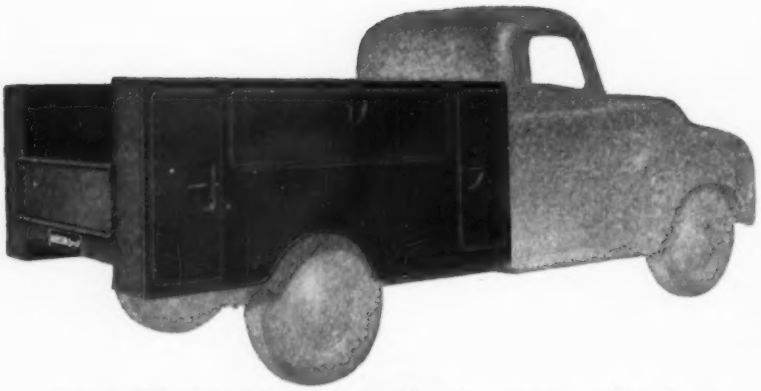


• Carry-All Model B-910 for all standard 3/4 and 1 ton chassis . . . 37¼ cu. ft. compartment area . . . over 30 sq. ft. floor area . . . can be fully enclosed with Carry-All Caravan Top or Carry-All Sliding Roof. Model B-750 fits all standard 1/2 ton chassis.

MORRISON

Carry-All

SERVICE BODIES

YOUR TRUCK IS YOUR TRADE MARK

. . . Use it to Build Your Business

Many of your potential customers only get to know you by seeing your truck . . . make sure it is doing a selling job for you! A Morrison Carry-All Service Body on your truck says, "This is a reliable business, efficiently operated."

Even more important . . . with 6 lock-equipped, weather-tight compartments . . . adjustable shelf and tray arrangements . . . added cubic feet of carrying space . . . and a wide selection of specialized accessories . . . a Morrison Carry-All Service Body actually pays for itself with on-the-job savings in time and labor. What you need . . . when you need it . . . where you need it . . . for every job! Here is a truck body — for any 1/2, 3/4, or 1 ton chassis — designed for your exact business needs . . . without the "custom-built" price.

Drive the best-looking truck . . . ask your local truck dealer about Morrison Carry-All Service Bodies or call — wire — or write . . .

PAY AS LITTLE AS

$29.50 monthly

Write Today for Illustrated Literature and Detailed Specifications

CARRY-ALL DIVISION

MORRISON STEEL PRODUCTS, INC.

683 AMHERST STREET, BUFFALO 7, N. Y.

Also manufacturers of MOR-SUN Furnaces and ROLY-DOOR Steel Garage Doors. Literature on Request.

Window Ventilator (28)

Model V-710 Chrom-Ever reversible window ventilator is made with an adjustable frame that will fit all standard windows from 25 to 41 inches. Frame is of heavy gauge steel with a rust resistant metallic finish. Unit also has a cast aluminum center in which the fan unit assembly is mounted. Motor is air-cooled.

Chrom-Ever Company, Division of Asquith Associates, Inc., 1150 *Broadway, New York* 1, *N. Y.*

Cable Cutter (29)

A cable cutter with a handle pull and a capacity up to 3½ inches—lead sheathed and power cable (except submarine cable) up to 3000 MCM. It is hydraulic, rests on floor or flat surface, may be bolted down. Long swivel type handle eliminates stooping and may be operated at any angle. Requires seven strokes per inch. Hydraulic jack is self-retracting and may be stopped at any desired cutter opening by means of release valve. Cutting edge is protected by brass insert in anvil.

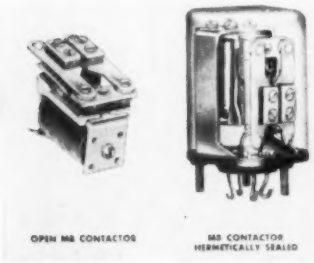
H. K. Porter, Inc., 74 *Foley St., Somerville* 43, *Mass.*

Instrument Testing (30)

A new testing instrument called the "Industrial Multi-Amp". This portable high current test unit now makes it possible to check circuit breakers, overload relays and other current-actuated devices before they are installed, when they are installed, and periodically after they are in service. It is adjustable in stepless increments with fingertip control. Rating

is 1 kva; input: 0-10 amperes; 110 volts, 60 cycle, ac. Output adjustable from 0-500 amperes in 5 ranges.

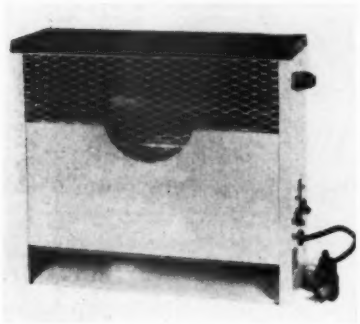
Multi-Amp Corporation, Harrison, N. J.



Contactors (31)

A new line of miniature, dc power contactors designated as the MB Series, has been developed for very high current applications in aircraft and similar equipment. Units are available open ($1\frac{13}{16}$ by $1\frac{5}{8}$ by $1\frac{7}{8}$ inches high) or in hermetically sealed "K" cans ($1\frac{13}{16}$ by $1\frac{5}{8}$ by $2\frac{1}{4}$ inches high). Open units are equipped with $\frac{1}{4}$ inch pure silver contacts and solid silver shorting bar rated at 60 amperes, 28 volts dc, non-inductive load. Contact arms are heavy brass with large, tinned solder terminals. Contact arrangement is 1 Form X (single pole, single throw; normally open; double make). Pin-hinged armature is equipped with spring assembly. Coils are wound on molded bobbins and impregnated with varnish for protection against moisture. Hermetically sealed contactors are similar in construction to open type except they are equipped with Kovar glass, solder terminals rated at 16 amperes, 28 volts, dc, non-inductive load. Each unit is equipped with three 6-23 mounting studs in $1\frac{13}{16}$ by $1\frac{3}{16}$ inch triangular pattern.

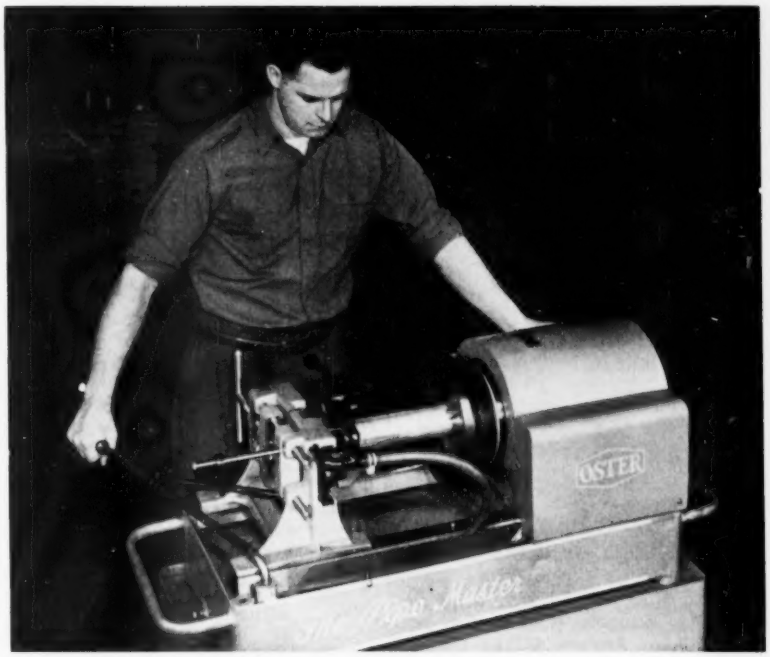
Potter & Brumfield, Princeton, Ind.



Heaters (32)

Navy type air heaters are now available for industrial and domestic use. Various sizes up to and including 15 kilowatts, voltage as required. Called Safe-T-Glo, Type 2C-1320 watts, Underwriters approved, two heat, with 6 ft. cord and plug.

C. C. Galbraith & Son Electric Corp., 450 Sixth Ave., New York, N. Y.



The OSTER "Pipe Master" can pay for itself in 66 days or less

PUT an Oster "Pipe Master" to work for you, and in just 66 days it pays for itself. From then on it will pay you a profit of $7.75 a day.

Facts prove that to cut-off, ream, and thread a 2" conduit by hand takes 7½ minutes. With an Oster "Pipe Master" it takes about 1 minute—saving more than 6 minutes.

And time is money. Even if your labor cost is only $2.25 an hour and you add nothing for overhead, those 6 minutes will save you 23¼c on every piece of 2" conduit you thread with an Oster "Pipe Master". If you thread 36 pieces in a day, it adds up to $7.75. And in 66 days the machine pays for itself. Profits to you on other sizes up to 2" conduit are similar.

The Oster "Pipe Master" delivers these profits because it's fast, dependable, and sturdy. It's simple to operate and easy to move . . . always ready to give you accurate threads that assure tight, safe make-up.

Your Oster Distributor can help you solve your threading problems. He offers sound recommendations, speedy delivery, and dependable service . . . and he stands behind the products he sells. Contact him for money saving facts, or if you don't know who he is, fill out the coupon below and send it to us.

THE OSTER MANUFACTURING COMPANY
2081 East 61st Street • Cleveland 3, Ohio

☐ Send me Profit Proving facts on the Oster "Pipe Master".
☐ Send me the name of Oster Distributor in my area.

Name_____

Company_____

Address_____

1893 • CELEBRATING 60 Years Leadership in the Threading Industry • 1953

MARTINDALE

MODEL 52 V.A.O. TESTER

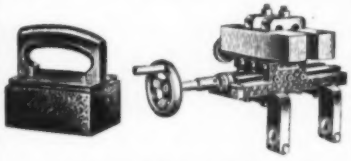
This new, sturdy, portable instrument has 5" meter,—Four testing ranges: Volts, AC and DC: 0-10.0-50, 0-250, 0-1000, AC only: 0-2.5: Amperes, DC only: 0-10; Ohms: 0-1000, 0-10000; Megohms: 0-1, 0-100. Selector Switch provides four positions: Volts AC, Volts DC, Ohms, Amps. Range Switch has 5 positions which provide for above Voltage ranges, 4 ohm ranges, and 1 ampere range. 4' test lead has both prods and alligator clips. Has sturdy, leather carrying case.

ADJUSTABLE BENCH GROWLER

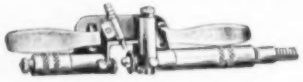
Has adjustable jaws with face length of 2½". With jaws closed will test armatures as small as 1" diameter. With jaws open, will accommodate armatures as large as 18" diameter.

Available with or without meter. Also six other models.

MARTINDALE COMMSTONES AND COMMUTATOR GRINDING TOOLS



MICA UNDERCUTTERS FOR SLOTTING COMMUTATORS

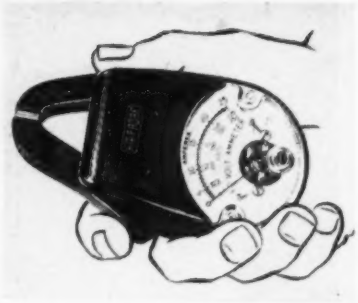


Nine Motor Driven Types

Write for New 64-page Catalog No. 29 describing these and many other products for Industrial Maintenance, Safety and Production

MARTINDALE ELECTRIC CO.

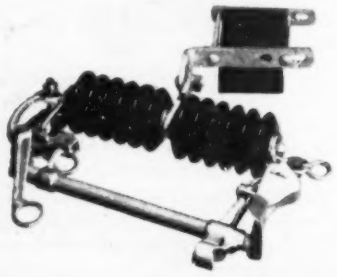
1309 Hird Ave. Cleveland 7, Ohio



Instrument (33)

The Amprobe Junior, a new snap-around volt-amp tester measures current instantly without shutdowns or ammeter connections. It is a voltage meter which gives an accurate voltage reading on a full-size 1.8-in. calibrated scale. To measure current without ammeter connections, snap trigger-operated jaws around one conductor (insulated or uninsulated). To measure voltage, plug test leads into instrument. Choose range that fits a particular job: Model "10": 0-10 amps ac; 0-125/250 volts ac. Model "25": 0-25 amps ac; 0-125/250 volts ac. Model "50": 0-50 amps ac; 0-125/250 volts ac. Model "100": 0-100 amps ac, 0-125/250 volts ac. Other features include: 3-in. d'Arsonval high-torque movement with Alnico 5 magnet. Probe jaws insulated, and tapered for "hard-to-get-at" wires. Safety-type voltage test leads.

Pyramid Instrument Corp., Lynbrook, N. Y.



Switch Cutout (34)

A load break switch cutout, Type L-33-D, has been added to this line. It affords full load break operation up to the cutout's continuous current rating of 100 amperes. By pulling lever arm with a hookstick fuse link is broken within the tube causing the fuse to operate as under moderate fault conditions. Cutout also features principle of controlled venting. This method of venting allows gases created under heavy fault conditions to escape in opposite directions at both ends of fuse tube. Type L-33-D requires the use of a conventional universal button head fuse link. Cutouts are available in 5, 7.5 and 15 kv, in continuous current ratings of 100 amperes and in interrupting ratings of 2,500 and 4,000 rms amperes.

Southern States Equipment Corp., Hampton, Ga.

Scaffold (35)

The new Scaf-Fold features removable gate-leg out-riggers with leveling screws. Work platform not only telescopes up and down, but also folds in and out. It is recommended for tight spots such as getting into and out of small elevators, doorways, etc., also for all overhead maintenance such as lighting, cleaning, etc. Unit comes in one piece.

Atlas Industrial Corporation, 849-39th Street, Brooklyn 32, N. Y.

White Range Outlet (36)

3826-W a white receptacle has been added to this line. It incorporates the sturdy construction of P&S 3826 and its easy wiring features, plus a white finish that is desirable for kitchen installations. There is plenty of wiring room between cable clamp and terminal block so that pliers can be used to position cable. Large radius on ends of heavy phosphor bronze contacts permits cap to be inserted easily. Cable clamp closes opening regardless of size of wire used. Self-positioning aligning ribs and grooves in cover and block eliminate breakage of covers in installations.

Pass & Seymour, Inc., Syracuse 9, N. Y.

get the *best* in a time switch
choose a Sangamo!

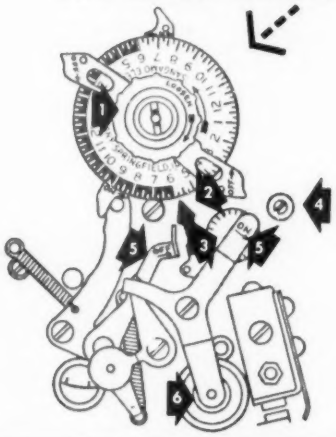
For automatic on-off time control on installations where you can't afford a failure—choose a Sangamo Time Switch. These high quality switches have a reputation for giving greater value—for offering efficient, unfailing on-off control for years and years in the most exacting installations.

There's a good reason why Sangamo Time Switches are so universally recognized as the finest—they were *never* built to merely meet minimum requirements!

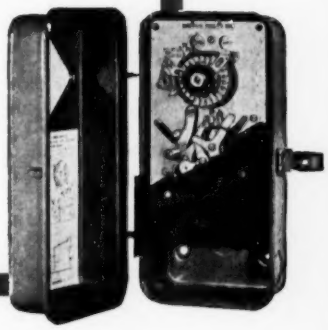
Sangamo Heavy Duty Time Switches provide a considerable *extra* margin of dependability at only slightly higher cost. They are available for almost any conceivable application, from the simplest on-off operation to complex multi-operation schedules.

here's the reason...

for more accurate, positive time settings:



1. **Locking knob facilitates accurate settings of time levers.**
2. **Red time indicating pointer readily visible.**
3. **Minute indicator for closer settings.**
4. **Vernier setting for greater accuracy.**
5. **Manual On and Off tripping levers clearly marked.**
6. **Roller provides friction-free contact operation.**



* Your electrical wholesaler can furnish all types of *dependable* Sangamo Time Switches. See them before you specify the time control for your next installation. Bulletin 1010 tells the full story—write today.

SANGAMO
ELECTRIC COMPANY
SPRINGFIELD, ILLINOIS

for your most exacting installations

ST53-1

NOW! Keynote opens the door to real push button value. Excellent in design. Low in price. Enduring and dependable . . with the outstanding, famous quality of all Edwards products.

GOOD DESIGN! Smart classic simplicity that complements all types of architecture. Slim and streamlined for narrow door trims.

PIANO ACTION! Instant positive contact at feather touch.

NEVER TARNISHES OR CORRODES! Lifetime finish needs no polishing. All exposed parts heavy plastic . . always in working order . . never rusts or stains outside of house.

EASY MOUNTING! Convenient surface mounting . . with just two screws. Covers old doorbell opening. Not necessary to drill or ream special hole for wires.

SMART COLORS! Brown, ivory, chrome*, brass*, with contrasting push-key. Blends with all exterior finishes.

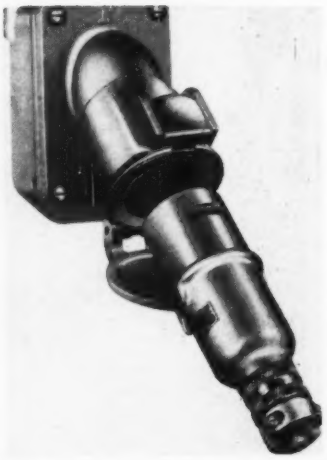
FINE QUALITY . . LOW COST! Outstanding push button in the economy class. Exceptional good looks. Finest performance. Just 26¢ to 52¢ each, depending on color.

*Edwards special 'Vaculized' finish gives the lustrous beauty of polished brass or chrome.

ASK YOUR ELECTRICAL SUPPLIER ABOUT KEYNOTE!

EDWARDS

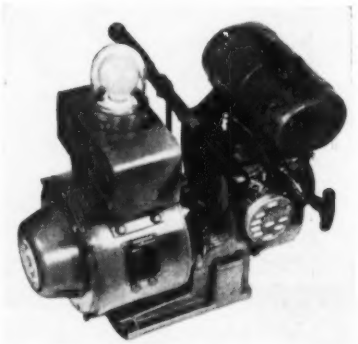
EDWARDS COMPANY, INC., NORWALK, CONN.
In Canada: Edwards of Canada, Ltd.



Plugs and Receptacles (37)

A new series of explosion-proof plugs and receptacles designated EPD and ERR, with the trade name Strate-Line. Connectors are designed for operation of portable electrical equipment in Class I, group C and D hazardous locations and are listed by Underwriters' Laboratories. In addition, they operate as a current-rupturing device, providing a safe and positive means for opening and closing circuit under load. The delayed action lock makes it impossible to open or close circuit except when contacts are confined within the explosion-proof chamber. Plug is inserted and withdrawn in a straight line. They have cast aluminum alloy housings with an extra pole connected directly to the shell for completing the grounding circuit through the conduit system. Designed for 15 and 30 amperes, 2-wire 3-pole and 3-wire 4-pole.

Pyle-National Company, 1335 N. Koster Ave., Chicago 51, Ill.

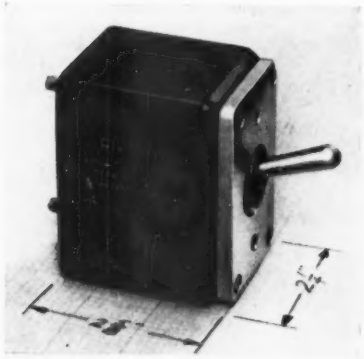


Generator (38)

A gasoline driven generator which provides an independent source of electricity. Available in two models, generator will serve as a power supply for portable electric tools having universal motors, which are often used in locations where current is not readily available. Model 119 is a 1500 watt dc unit supplying 115 volts at 13 amps. It has a 3 hp single-cylinder engine and four electric outlets. It weighs 75 lbs and can be carried by one man.

Model 118 is similar to the 119 except that it provides ac and weighs 135 lbs. It is equipped with a two-man carrying handle and can also be transported by car or on a hand truck.

Porter-Cable Machine Co., 18 Exchange St., Syracuse, N. Y.



Toggle Switch (39)

A new ordnance-type heavy-duty waterproof toggle switch. It is dust-tight, easily installed, functions from 65° below zero to 165° above, and withstands shock, vibration and salt spray. Switch mechanism is encased in a rubber compound. A rubber boot acts as a waterproof seal around the toggle and between mounting plate and switch itself. Continuous rating of switch is 175 amperes at 15 or 30 volts dc or 125 volts ac. Maximum inrush capacity on any type of load is 500 amperes. Toggle and pole arrangement is for SPST. Switch can also be wired in multiple as DPST. Overall dimensions are 2½-in. by 2⅝-in. by 3½-in., with toggle extending 1-7/16-in. beyond mounting plate at top of its travel. Although developed primarily for ordnance use, switch is suitable for many other applications calling for a sealed switch mechanism.

Riverside Manufacturing & Electrical Supply Co., 10228 Michigan Ave., Dearborn, Mich.

Alarm System (40)

New model "TC" tele-counter which keeps continuous count of every off-normal signal as indicated by the Tel-Alarm Annunciator. Any number of individual alarm points of the alarm system may be selected for totalizing or the entire unit may be equipped with the Tele-Count device. In addition to the individual totalizers, it is designed with signal sequence selection, whereby the initial off-normal signal at the annunciator is indicated by an engraved, illuminated window placed directly above the corresponding counter totalizer. Both types of Tele-Counters can be adapted to any existing Tel-Alarm annunciator system. They are available in any multiples to correspond to the equivalent number of stations on the original annunciator panel or any selected portion of it.

Tigerman Engineering Co., 4332 N. Western Ave., Chicago 18, Ill.

"Blackhawk BENDERS are just plain handier and really portable"

ROLL OR CARRY EASILY TO JOB

WORK AT ALL ANGLES

BEND ON THE BENCH OR OVERHEAD

SPOT FROM ANY ANGLE

WRITE FOR THIS HELPFUL—CATALOG 50B. It fully describes Blackhawk Hydraulic Benders and 60% faster Knockout Punch Drivers.

More speed-minded contractors and crews are changing over to Blackhawk

COMPARE *all* pipe benders and you'll discover Blackhawk gives you a spectacular edge in speed and ease of workmanship!

Big difference is the design of the hydraulic unit. With Blackhawk's "Porto-Power" Bender you can pump from *any spot* because the hydraulic pump is *separated* from bender by a flexible safety hose. Bender works in any position — on its side or upright . . . on table or floor . . . on existing runs. A man can move around, "jockey" the pipe with one hand — sight along it if necessary . . . without stopping the pumping. What's more, there's a Blackhawk Bender for every popular size of conduit — rigid and thin-wall. Remember, too, the "Porto-Power" hydraulic jack can also be used to lift machinery, pull pulleys, lick dozens of allied jobs.

On job after job, crews who have a choice of benders prefer Blackhawk. They know Blackhawk works better, faster. And that means more profits. Get your "Porto-Power" Bender and other Blackhawk Electrician's Equipment *NOW* from your Electrical Wholesaler or Industrial Supply Distributors.

BLACKHAWK

HYDRAULIC TOOLS • HAND TOOLS

CLIP AND MAIL COUPON TODAY

BLACKHAWK MFG. CO.,
Dept. P-2063, Milwaukee 1, Wisconsin

Rush free Catalog 50B on Blackhawk's Electrician's Equipment

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We can supply
your requirements
for

Cotton Insulating-Tapes
from .004" to .027" thick

Cotton Sleeving
from 1/32" to 1-1/2" I.D.

Cotton Webbing of all descriptions

Samples and prices sent promptly upon request

GRAHAM TAPE & WEBBING CO.

P.O. BOX 207
PAWTUCKET, R. I.
Manufacturers of above listings

PAY JOBS···
JACKSON REFLECTORS
SOLD ONLY THRU DISTRIBUTORS

1026

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Every job is a profit job when you have the Jackson line of INDUSTRIAL REFLECTORS. Your customers get good service with a minimum of maintenance — at reasonable cost. You get quality and prompt service that pays off on every installation.

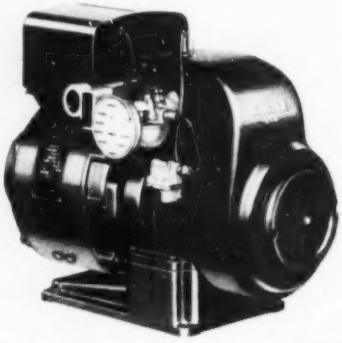
Manufacturers of
Reflectors
Yardlights
Vaporproof Units
Weatherproof Sockets

• Available immediately at your wholesaler
SEND FOR CATALOG

Time Switch **(41)**

An improved design of 300 Series time switches incorporates improvements in the terminal block, to permit faster installation and "shock proof" connections. Redesign of contact arms in switching mechanism insures more positive locking in the "on" and "off" positions, while retaining fast make and break switching action. The series provides "on-and-off" switching for applications requiring up to four operations per day. Switches are provided with a "skip-trip" feature which permits hand tripping, when desired, ahead of the automatic setting, without disturbing the normal operating sequence. Dial and trippers may be set without the use of tools. Switches are designed for sign lighting, stokers and oil burners, illuminated billboards, automatic flushing operations, intermittent motor operation, farm lighting and show-window lighting, in addition to many other commercial and industrial operations.

Paragon Electric Company, Two Rivers, Wis.



Electric Plant **(42)**

The first of a series of new electric plants designed for various portable and semi-portable jobs requiring electric power generated at the site. Generating 1000 watts, the plant, designated as model 1A21, is for cottages, camps, farms and comparable applications. It is automatic, starting when any lamp bulb (40 watts or larger), appliance or motor connected to the plant is turned on. Plant automatically stops when all loads are cut off. The 1A21 will operate 40 25-watt bulbs at one time, or appliances such as a radio, fan vacuum cleaner, water system, washing machine, refrigerator and various types of power tools. Available in an automatic model, which starts and shuts down as load requires, a portable model and a pushbutton model. All are available for gasoline or natural gas operation.

Kohler Co., Kohler, Wis.

Boom **(43)**

The Hydro Sky Worker is a new model of hydraulically operated boom for aerial work. Mounted on a truck, tractor or dolly, it can carry one or two men to a working position at any point in space within a 26 foot radius of the mooring. Elevations up to 44 feet working height are possible with the standard model. In addition to the articulated "elbow", special features include an insulated crow's nest, a micarta insulated boom for operator's protection near high voltage wires, working load capacity of 500 lbs and a 360° rotation with movement controlled from the crow's nest. Mounting design is such that it allows ample body space on truck for compartmentation and carrying of a maximum load of auxiliary equipment.

Tey Manufacturing Co., Milford, Conn.

Intrusion Alarm **(44)**

Intrusion alarm set P1A provides positive intrusion and burglary protection for offices, stores, government and industrial properties. Equipment provides a protecting wall of invisible light across any space up to 50 feet. Set consists of control Type A20C-2 and light source Type L60B. An invisible infrared beam is projected from light source, spanning any distance up to 50 feet. This is aligned to strike the "eye" of the control. Momentary interruption of beam actuates control relay, which is wired to operate and sustain an external alarm device. Alarm can be silenced by restoring electrical circuit to original conditions by use of a manual or automatic reset switch. Relay is single-pole, double-throw, 10 amperes, 115 volts ac.

Photoswitch Incorporated, 77 Broadway, Cambridge 42, Mass.

BIDDLE
Instrument News

- ELECTRICAL TESTING INSTRUMENTS
- SPEED MEASURING INSTRUMENTS
- LABORATORY & SCIENTIFIC EQUIPMENT

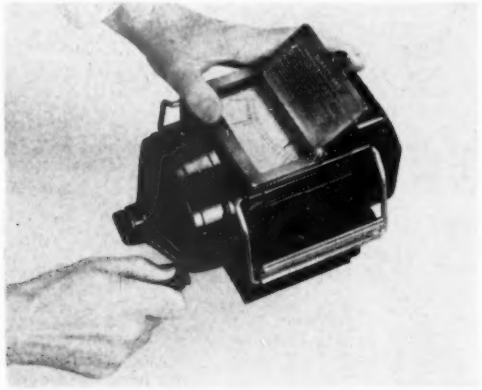
JAMES G. BIDDLE CO., 1316 ARCH ST., PHILADELPHIA 7, PA.

Tips on TESTING . . .

TEMPERATURE-RESISTANCE CHARACTERISTICS OF ELECTRICAL INSULATION

Composite Nature of Electrical Insulation

The insulation of electrical equipment is usually of composite construction, electrically in parallel or in series or both. And in practice, when the insulation resistance of equipment and its associated circuits is measured together, the insulating materials involved become even more diversified. If the component materials are built up in series only, then that material having the highest volume resistance will usually control the temperature effects, whereas in parallel arrangements, the material having the lowest resistance will usually control.



YOU CAN TELL from Megger readings if insulation is going bad before it breaks down; saves time and repair bills.

The insulation of rotating equipment and other dry-type apparatus, also includes a wide variety of materials, either organic or inorganic, or both, such as molded or paper-bound mica in Class B insulation, and paper, pressboard, and treated cloth in Class A insulation.

A.I.E.E. Standards list the five classes of insulating materials repeated in brief form as follows:

Class O—Organic materials—not impregnated.

Class A—Organic materials—impregnated.

Class B—Inorganic materials with organic binding substances, and a small proportion of Class A material for structural purposes only.

Class H—Inorganic materials with binding substances composed of silicone compounds, or materials with equivalent properties.

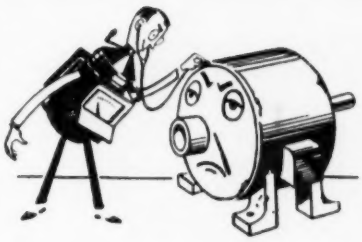
Class C—Inorganic only.

Composite insulations in any one of these classes may include several different kinds of material falling in the same class, which means that the temperature-resistance characteristics of insulating structures in the same class may vary, as well as the structures in different classes.

The fact that the insulation resistance of a material includes both its volume and surface resistance must also be considered, and for most practical cases, that portion of the leakage current which flows through the body of the dielectric is small in comparison with the portion which flows through the surface film. The presence of surface films should therefore affect the temperature characteristics of insulating materials.

NOTE: The above material is taken from our Technical Publication 21T4 which summarizes and discusses some of the published and available unpublished information on this important and rather difficult subject.

Write on your company's letterhead for your copy of **BULLETIN 21T4-ECM.**



WHAT'S SO SPECIAL . . . about a MEGGER® Insulation Tester?

To quote a well known motor car manufacturer, "Ask the man who owns one". Right, when you want the straight story on an instrument like the Megger Tester that has to perform dependably and efficiently, *ask the men who own them.*

After almost 50 years of supplying these instruments to industry we know that they are their own best salesmen. We do not sell you a Megger Tester—you buy it on its time-tested and field-proved performance. *Why* is it the favorite?

Electrical men everywhere in the world prefer Megger Testers for these reasons:

Easy to use—Light weight (only 8 lbs.), entirely self-contained with a constant-voltage generator—no dependence on batteries or other current supply.

Easy to read—Direct reading in ohms and or megohms, no keys to press or dials to adjust and accuracy is independent of the exact speed of the generator or strength of the permanent magnets.

Rugged and reliable—These instruments withstand long hard use far beyond the normal expectancy of the average delicate instrument. Because of their sturdiness and never-failing power-supply they are ideal field instruments.

Low cost—The purchase price of a Megger Tester has little bearing on its value. One test of a valuable piece of equipment may result in savings of several times the cost of the instrument.

James G. Biddle Co.
1316 Arch St., Phila. 7, Pa.

Gentlemen:

Please send me **BULLETIN 21T4-ECM.**

Attached is my company letterhead.

NAME

JOB FUNCTION

COMPANY

ADDRESS

JAMES G. BIDDLE CO.

- ELECTRICAL TESTING INSTRUMENTS
- SPEED MEASURING INSTRUMENTS
- LABORATORY & SCIENTIFIC EQUIPMENT

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PHILADELPHIA 7, PA.

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for
ELECTRICIANS
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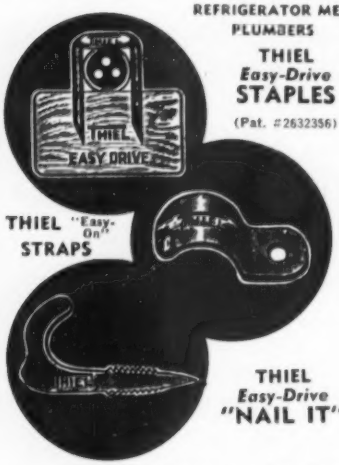

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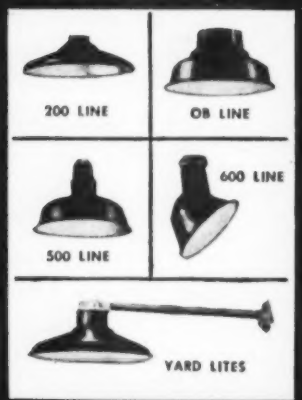

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Control Panel (45)

New control panel for automatic heating and power equipment is designed for proper mounting and wiring for commercial and industrial controls, regardless of fuel used. Panels are supplied in standard assemblies for most frequently used types of controls. Standard controls are for 230-volt, 60 cycle. All controls, switches, instruments and gauges are mounted and wired at factory. Terminal strip is provided for field connections of external wires leading from panel to burner-mounted controls. A switch permits manual starting and stopping of burner; a second switch allows holding burner in low-fire position.

Iron Fireman Mannufacturing Co., Cleveland 11, *Ohio*

FHP Motors (46)

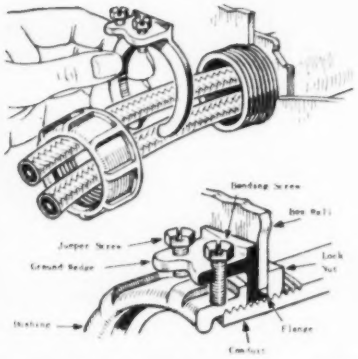
Two new special-service, fractional-horsepower motors, for applications requiring moderately high starting torque. Rated at ½ and ¾ hp, 1725 rpm, they can be mounted in any position, and are reconnectable at the terminal board for 115 or 230 volts. With starting currents which conform to NEMA standards, motors can be used in evaporative coolers, attic fans, milking machines, compressors, garage tools, and home workshops. They are an extension of the 1/4-1/3 hp Form G special-service motor series.

General Electric Co., Schenectady 5, *N. Y.*

Fuse Cutout (47)

Type HCO, 100 ampere open type heavy duty cutout was designed to meet the need for a high interrupting capacity distribution cutout. Rated at 5 kv, 7.5 kv and 15 kv, it has an interrupting capacity of 8,000 amperes. Operation is based on the principle of single venting of fuse tube on low faults and double venting on high faults. When low faults occur (approximately 2,000 amperes and below), expulsion gases are vented from bottom of tube which allows enough pressure to develop to blow out low fault arc in tube. On faults above 2,000 amperes, the added pressure operates a diaphragm in the expandable cap to allow venting from top of tube as well as bottom.

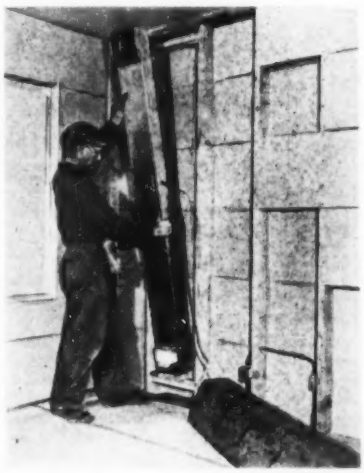
Line Material Co., Milwaukee 1, *Wis.*



Grounding Wedges (48)

Horseshoe shaped grounding wedges can be slipped over existing wiring and positioned so that installation screw is easily fastened. Next the wedge is clamped between conduit or metallic insulated bushing and junction box. This permits standard conduit bushings to be converted to approved ground bushings, if necessary. Grounding wedges eliminate a bonding jumper in many cases, but also provide for connecting a jumper when installed in concentric knockouts. Approved by Underwriters.

Thomas & Betts Co., Elizabeth, N. J.



Electric Heating System (49)

A new electric circulating air heating system, known as Electrend. Unit is a metal duct 7 ft high, 8 in. wide and 3½ in. deep. There are two openings covered by grilles, one each at top and bottom. Inside the upper grille a fan unit is mounted. This draws off layer of warm air and sends it down over a heating element located above lower grille. One or more ducts are mounted between studding of walls in each room. System is completely automatic. Thermostat is mounted at proper level on front of each unit, controlling each room separately. Units are wired for 110 volt, 60 cycle. Can be wired for 220 volt if desired. Dual switch operates fan alone for air circulation in hot weather.

Electrend Products Corp., St. Joseph 2, *Mich.*

Product Briefs

(50) A new Class H silicone rubber coated glass cloth **insulation** with high dielectric strength and increased tensile strength has been introduced by Mica Insulator Co., Schenectady, N. Y. . . . (51) Ward Leonard Electric Co., Mount Vernon, N. Y., has developed Bulletin 68 plunger **potentiometers** designed for industrial electronic control applications. . . . (52) A new Fiberglas insulating product for lining the interior of air conditioning or warm air ducts called flexible **Duct liner** has been introduced by Owens-Corning Fiberglas Corp., Toledo, Ohio.

(65) A new "Springload" **bench vise**, designed with a spring and ratchet arrangement has been announced by Springload Mfg. Corp., Seattle, Wash.

(54) A new "U" series of sub-miniature hermetically sealed **connectors** in the round shell design has been introduced by Cannon Electric Co., Los Angeles, Calif. . . . (55) Sub-Zero Products Company, Cincinnati, Ohio, has announced a low temperature **chilling machine** designed for cold testing. . . . (56) A new line of lightweight hanger-type indoor luminous tube **transformers** has been announced by General Electric Co., Schenectady, N. Y.

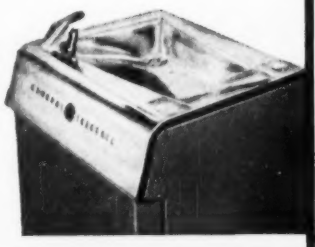
(57) Ram Tool Corp., Chicago, Ill., has developed a new **saw** called Power-Guide. . . . (58) A new ACSR pre-splice **cutting tool** which cuts the aluminum strand without damaging supporting steel core has been introduced by Interstate Drop Forge Company, Milwaukee, Wis. . . . (59) Carboloy Department of General Electric Company, Detroit, Mich., is manufacturing a new type carbide-tipped, self cleaning **drill**.

(58) An automatic **thermostat** that keeps an air conditioned room at the desired temperature level has been announced by Mitchell Manufacturing Co., Chicago, Ill. . . . (59) Corona Mfg. Corp., Glendale, Calif., has developed Merco infrared Pyrex tube **oven sections**. . . . (60) The Martindale Electric Co., Cleveland, Ohio, has announced a new Model D-3 **demagnetizer**.

(61) American Aerovap Inc., New York, N. Y., has announced a **bug bulb** for killing insects. . . . (62) A new model Zip-Lift **electric hoist** with rope control has been developed by the Harnischfeger Corp., Milwaukee, Wis. . . . (63) Dayton Safety Ladder, Cincinnati, Ohio has designed a "Roll Along" safety **ladder** for service wherever an easily moved step ladder is required.

(64) Farrelloy Company, Philadelphia, Pa., has developed **Hy-Tin**, which is a paste containing powdered solder suspended in a scavenger action flux which cleans and tins in the same application.

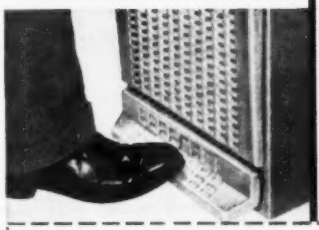
TAKE A LOOK at a really NEW water cooler!



Diamond Anniversary

GE

WATER COOLER



You've never seen a water cooler like this before. It's the all-new Diamond Anniversary G-E Water Cooler—and it sparkles with far-ahead features. *New compactness* (requires 30% less floor space). *New operating ease* (no-grope recessed foot-pedal stretches the width of the unit). *New cooling dependability* from the same famous G-E compressor that makes the G-E Refrigerator a leader. *PLUS advanced styling*—striking enough for the smartest shop, yet so functional and sturdy it's right at home on a factory floor!

Water's never too chilled for enjoyment... never too warm or flat (dial the temperature you want). No unexpected shower-baths, either, thanks to G-E automatic air-pressure vent.

Learn how you can earn extra income without extra overhead by selling the G-E Water Cooler Line. Send in the coupon, or phone your nearest G-E wholesaler.

(Upper left.) **STAY-CLEAN, SANITARY** electro-polished top. One-piece construction, deep apron. Fast-draining big basin.

(Lower left.) **NO-GROPE FOOT-PEDAL** is directly linked to control valve. Unit finished in handsome hammered gray.

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Rush full particulars on the G-E Water Cooler Plan.

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Catalogs, Bulletins and Engineering Data

(65) Induction Motors, weather-protected, of 250 hp and larger; construction features of the base-ventilated and grade-mounted designs; diagrams of ventilation systems, table based on hp and desired rpm. 4 page two-color bulletin. General Electric Co.

(66) Electrical Connectors of quick disconnect design with positive pressure contact and self-wiping action for wide range of wire sizes; descriptions of operation, performance and applications; dimensions, photographs, schematics, exploded views and graphs. 12 page two-color bulletin. AiResearch Mfg. Co.

(67) Electrical Insulation, both fibre and plastic; complete descriptions, tabular data and other information on grades, properties and fabricating techniques for sheets, rods, tubes and molded parts. Two catalogs, 8 and 32 pages. Insulation Manufacturers Corp.

(68) Gear Motors rated from 1/6 to 200 hp; their function, design and application; cut-away photographs, electrical characteristics and maintenance hints. 16 page bulletin in two colors. General Electric Co.

(69) Industrial Controls, including non-indicating electric, electronic and pneumatic controllers, electric and pneumatic valves, switches and relays; specifications, dimension drawings and application data. 80 page bulletin. Minneapolis-Honeywell Regulator Co.

(70) Wiring Devices and interlocking devices; pictures and descriptive explanatory diagrams showing details of manufacture. 1953 catalog. Rodale Mfg. Co., Inc.

(71) Wires and Cables for the chemical and petroleum industries; 76 page booklet in four sections: insulation compounds, jacket compounds, construction and technical data. United States Rubber Co.

(72) A-C Welding Machines of three basic types: a general purpose unit, a 200-ampere unit with built-in high frequency stabilizer and an 80-volt general and special purpose unit; electrical specifications, physical dimensions and weights, description of optional equipment and standard accessories. Westinghouse Electric Corp.

(73) Electrical Conduit for use in wet locations; flexible and liquid-tight with galvanized steel core, positive ground and synthetic cover; affords protection against moisture, dirt, chemicals and corrosive fumes. 4 page bulletin. American Brass Co.

(74) Electric Controls for industrial, marine, military and power plant applications; motor controls, switchgear, generator controls, marine propulsion systems and industrial process controls. Lake Shore Electric, Inc.

(75) Power Packs for maintaining proper voltage level in ac lighting and power service up to 112.5 kva at 600 volts or less; single- or three-phase packaged unit includes dry-type transformer, dry-type induction voltage regulator and distribution panelboard. General Electric Co.

(76) Distribution Panelboard for plug-in service to 30, 60, 100 and 200 ampere, 250 volt circuits and to 30, 60 and 100 ampere, 575 volt circuits, both with 2 and 3 pole branches; exclusive features, specifications and enclosure sizes with installation suggestions. 8 page illustrated booklet. Federal Electric Products Co.

(77) Relays and Contactors for motor starting, power control and other electric and electronic applications; pictures, schematic drawings and charts with overall and mounting dimensions, coil and contact data. 24 page catalog. Potter and Brumfield.

(78) Protective Devices, and how to be sure they are protecting; description of new testing instrument for checking and calibrating such current-activated devices as overload relays and circuit breakers. 12 page illustrated booklet. Multi-Amp Corp.

(79) Wire and Cable for use in building trades, appliances, communications and electronics; reference tables, diagrams and charts showing construction, physical and chemical properties, and typical uses. 24 page catalog in two colors. United States Wire and Cable Corp.

(80) Resistance Welding, its how, what and why; suitable metals, essential steps, principal types of welds; description of electronic controls and accessories. 16-page bulletin. General Electric Co.

(81) Lighting Fixtures for the residence; glass, fibre glass or crystal with chrome or brass trim for interior walls and ceilings; glass with brushed copper or brass trim for outdoor use; variety of sizes, shapes and colors. 32 page booklet in full color. Glatthar Lighting.

(82) Rheostats for overall service in four sizes: 50, 75, 100 and 150 watts with ranges from 0.5 to 10,000 ohms; charts showing maximum current and number of steps, dimension diagrams and specifications. 4 page bulletin. Hardwick, Hindle, Inc.

(83) Gear Motor scale drawings available to draftsmen, designers, engineers and architects; furnished on 8½ in. by 11 in. paper, designed to be inserted under layout of machine equipment; three views of each of 30 motors including single and double reduction and worm type Syncrogears from 1/3 to 30 hp at speeds of 5 to 10,000 rpm; includes booklet of dimensions, specifications and shipping weights. U. S. Electrical Motors, Inc.

(84) Magnetic Amplifiers, self-saturating, for high-gain dc amplification in industrial, educational and laboratory control and instrumentation circuits; explains theory of operation, defines terms, describes characteristics with graphs and charts. 8 page bulletin. General Electric Co.

(85) Insulation Materials for motor armatures and stators, transformers, bus bars, coils and relays; sketches, test data and physical properties. 4 page bulletin. Electro-Technical Products.

(86) Indicator Lights, sub-miniature, of dimming or non-dimming types for plastic plate edge lighting and lighting of dials and instruments; made to mount in 15/32 in. hole, equipped with midget flanged base bulb; diagrams and technical data. 4 page bulletin. Dialight Corp.

(87) Junction Boxes, over 500 cast iron types for almost every possible application, are illustrated and described in 12-page bulletin, including specifications and sketches on unflanged, flat flanged, inside-flanged for recessed cover and outside-flanged for recessed cover types and on many special types. O. Z. Electrical Mfg. Co., Inc.

Lighting Equipment is described and illustrated both as to type and service in completely revised 72-page full-color large lamp catalog including information on construction, operation and application. Price 70 cents. Write directly to General Electric Co., Lamp Division, Nela Park, Cleveland, Ohio.

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Reserve Power—for the extra-tough job. Powerful, Continuous-Duty Motors—built in PET's own factory. Dynamically Balanced Armatures—for freedom from vibration.
Six Heavy-Duty Ball and Needle Bearings.
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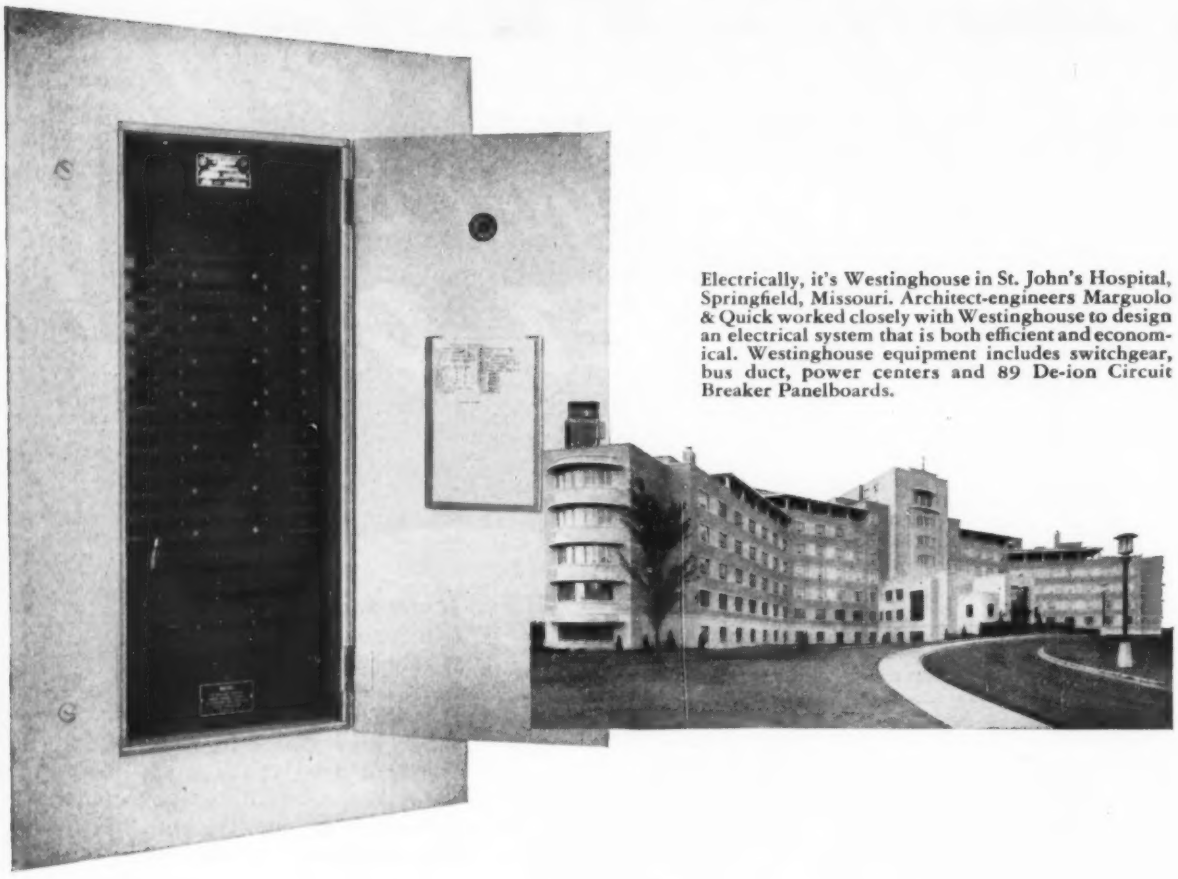

Electrically, it's Westinghouse in St. John's Hospital, Springfield, Missouri. Architect-engineers Marguolo & Quick worked closely with Westinghouse to design an electrical system that is both efficient and economical. Westinghouse equipment includes switchgear, bus duct, power centers and 89 De-ion Circuit Breaker Panelboards.

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Install Westinghouse Panelboards for maximum protection . . . lower job costs

In hospitals, an element of safety depends on the circuit protection provided by panelboards. That's why contractors are turning to Westinghouse De-ion® Circuit Breaker Panelboards for hospitals and other jobs where long-lasting dependability is all important. Westinghouse Panelboards not only incorporate circuit breakers using the well-known de-ion principle, but other features of construction which provide life-long, trouble-free service.

There's a Westinghouse Panelboard for any circuit protection problem . . . in any type of building. Thirteen assembly plants give fast service and quick delivery throughout the country.

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QUESTIONS from readers on problems of industrial equipment, installation, maintenance and repair. Answered by electrical maintenance engineers and industrial electrical contractors out of their experience. For every question and every answer published we pay $5.00.

Reader's Quiz

Expansion Joints

QUESTION C23—We have a steel frame, industrial type building about 500 feet long, with an expansion joint across the middle of the building. The actual movement of this expansion joint is about one inch, as indicated by the paint that has been scraped off. Bridge cranes traverse the length of the building, and where they cross the expansion joint, gaps have been provided in the copper trolley wire crane conductors.

These trolley wires are about to be replaced, and a saving will result if the trolley wires can be run continuously from end to end of the building, with no gaps across the expansion joint. What is the experience of your readers in this regard? Where a long building has expansion joints, must expansion joints also be provided in copper trolley wire crane conductors passing over these joints?—S.O.H.

ANSWER TO C23—Our machine shop is 1,000 feet long and has three 10 ton cranes (220 volts dc) running the length of it, passing four expansion joints. The cranes are fed from two 4/0 round copper wires running the length of the shop in one piece. The slack in the wires is supported on wood spools every 25 feet. We have had this set-up for 15 years and never think of expansion or contraction of the building.—G.S.B.

ANSWER TO C23—Main crane feeder cables may be mounted continuously and expansion provided for by using a simple spring mounting for one end of the cables. Each cable should be anchored to the building structure at one end through a strain insulator. The other end should be tied to a second strain insulator, then to one end of a steel rod. The rod passes through a hole in a support plate anchored to the building and perpendicular to the cable, then concentrically through a heavy coiled spring. The rod is threaded at the far end, where it is fastened to the spring by nuts and a block plate. The other end of the spring is fastened to the support plate. Insulators spaced twenty feet apart may be used to support the cables along their run.—O.C.

Interrupting Current

QUESTION D23—What type of current is the most difficult to interrupt and why—90° lagging current due to idling transformers, in phase currents such as resistance loads or 90° leading currents such as capacitors? Assume each of the three types of currents to be of the same amperage, voltage and frequency.—M.D.

ANSWER TO D23—Both experience and theory will reveal that the interruption of a 90° lagging power factor current will present the most serious problems. This may be explained briefly as follows: At the instant of interrupting an in-phase current of a resistive load, the potential across the load immediately decreases to zero. This then leaves a voltage across the switching gear equal to the line voltage. The highest voltage or current encountered is the line voltage and its steady state current.

If the above had been a 90° leading current (capacitive) the voltage across the load would remain equal to the line voltage at the instant of opening the circuit and the current would instantaneously drop to zero. This, just as in the in-phase current problem, does not present current nor voltages in excess of the steady state current or the line voltage. A possibility does exist, however, where the voltage across the switching gear could equal approximately twice the line voltage. This arises if the voltage across the capacitor were interrupted at its peak (either positive or negative). It can be seen that when the line voltage completes half of an additional cycle, the capacitor will be of opposite polarity to the line voltage and an approximate doubling of voltage across the switch would be found. This is not a real switching problem because of the time interval involved for the additional half cycle. i.e. 1/120th of a second.

The problem of breaking a 90° lagging current (inductive) as mentioned before, is the most difficult. The basic stubbornness of an inductance which tends to oppose any change in current flowing through it is responsible for the many problems encountered. This may be explained by the fact that the voltage across an inductance is directly proportional to the rate of change in its current. The opening of the switching gear on a 90° lagging current will make the instantaneous rate of change in current through the load exceedingly high which, as stated before, will develop a high voltage across the inductive load directly proportional to the rate of change in current. It is this voltage which will tend to cause a breakdown of dielectric be it air, oil, etc. long before that of a resistive or capacitive load of the same magnitude.—W.D.J.

ANSWER TO D23—The type of current least difficult to interrupt is the in-phase current. This is due to the fact that the voltage and current valves are passing through their zero valve at the same point of time so there is no voltage source existing to re-establish and cause the current to continue. Whether 90° lagging or 90° leading differ appreciably in interrupting difficulties cannot be stated definitely due to the variable circuit conditions.

Actually power factor of capacitor circuits may be lower than for idling transformers, hence greater difficulties can be expected in switching them. The writer has measured power factor for capacitor circuits indicating angles of 88° plus or virtually 90°. For an idling transformer power factors of arc between 10% and 20% indicating angles between 80° and 90°. In addition, the transformer winding has a resistance element making the interruption less difficult than for an essentially pure capacitor circuit. For a 90° phase difference the current would be maximum at zero voltage hence re-establishment is possible in the arc. —C.O.D.

Figuring Starting Resistance

QUESTION E23—I would like an easy and practical method for figuring the starting resistance and how to divide each step. The problem is a 5 hp 440 slip ring wound rotor motor, with a secondary voltage of 250 volts —secondary amps 6,—and 25% starting torque. I want to step all secondary resistance out, in 4 to 5 steps. How do I go about it?—D.J.S.

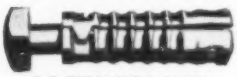
ARRO — the *complete* line of quality anchoring and drilling devices for masonry.

ARROFLUTE CARBIDE MASONRY DRILL

LAG SCREW EXPANSION SHIELD

A-C-E EXPANSION SHIELD

DOUBLE EXPANSION SHIELD

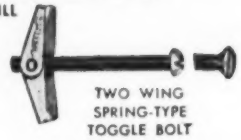

O-E EXPANSION SHIELD

MACHINE SCREW ANCHOR

STUD BOLT ANCHOR

LEAD SCREW ANCHOR

MAL-LEAD BOLT ANCHOR


TWO WING SPRING-TYPE TOGGLE BOLT

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FOUR-POINT HAND STAR DRILL

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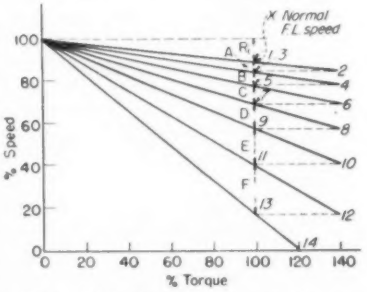
ANSWER TO E23—D.J.S. indicates that this motor should start with a torque of 25% which seems quite low to me unless the motor is driving a fan or compressor load. Most motors generally have a starting torque of over 100% and I have indicated on the accompanying graph the acceleration curves for a motor starting with 120% torque. For the resistor lay-out proceed as follows:

R_1 = Internal resistance of rotor
A = 6th. step of ext. start resis. 4.5 %
B = 5th. " " " " " 6.8 %
C = 4th. " " " " " 8.6 %
D = 3rd. " " " " " 12.0 %
E = 2nd. " " " " " 16.0 %
F = 1st " " " " " 24.0 %



Point 14 is determined from the application data of the driven machinery and a line from 100% speed to point 14 can be drawn. The intersection with the 100% torque line gives point 13. Draw a horizontal line through point 13 and make 13-12 equal to the accelerating torque desired. Then draw a line through points 11 and 12 from the 100% speed point. This fixes point 11. Draw a horizontal line through point 11 and make 11-10 equal to 13-12. A new line can then be drawn through points 9 and 10 from the 100% speed point thus establishing point 9. This process is continued until the speed-torque curve through points 1 and 2 intersects at point 1 which is the normal full load speed of the motor. Point 1 is also the internal resistance of the rotor. After this speed-torque diagram has been drawn, the intersections of the speed-torque lines with the unity torque line give the percent values of the starting resistance sections. These values have been indicated on the graph.

To convert these values to the required ohmic values it is necessary to know the base resistance of the motor. This base resistance can be determined by using the following formula:

R is equal to the generated secondary voltage at standstill divided by the normal full load secondary current times the square root of three or,

$$R = \frac{Es}{\sqrt{3} \times I_s}$$

This base resistance can be obtained from the motor manufacturer or it may be calculated as shown. After

CIRCUIT PROTECTION . . . so, what's the difference

There are many types of circuit protection devices on the market. Many of them are listed by Underwriters Laboratories since they pass certain safety test requirements.

Then, what makes HEINEMANN Circuit Breakers different? The difference is the HEINEMANN hydraulic-magnetic operating principle . . . eliminating thermal elements. Thus, you are assured instantaneous protection where you need it most . . . even on the small-sized shorts in lamp and appliance cords.

ALMOST HUMAN

With built-in time delay, HEINEMANN Circuit Breakers are almost human in their ability to differentiate between harmless and dangerous overloads. Delay is inversely proportioned . . . longer for small overloads; shorter for large ones. Time vs. per cent overload response curves may be selected to match the equipment or circuit requiring protection. *At ten times rated current, HEINEMANN Circuit Breakers always trip instantly* . . . providing the fastest circuit interruption available.

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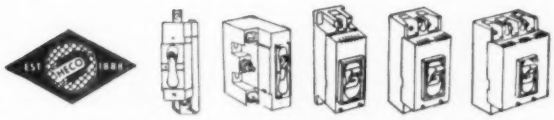

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the base resistance has been determined then the resistance values for each step can be found by simply multiplying the percent values of each step as found from the curves times the base resistance. This will give each step in ohms.

If a higher starting torque is desired then it is only necessary to relocate point 14 and proceed as indicated. If a lower starting torque is wanted then about the same procedure is followed except that the accelerating torque peaks will or may change depending upon the type of load on the motor. However, this graphical method will work out satisfactorily in either case. D.J.S. may be interested to know that this method may also be used to calculate the starting resistance for shunt or compound wound d-c motors.—R.W.M.

Fluorescent Lamps

QUESTION F23—What system can I use on a sequence start 8 ft. fixture so that the two bulbs will not go out when the first bulb starts to burn out? —H.S.

ANSWER TO F23—If both bulbs go out when one burns out you evidently have them both in series.

The most probable reason for having them both series is to get proper voltage on each bulb. By placing the bulbs in multiple you would eliminate your trouble but this would require using bulbs of the same size but of double their present voltage or using an auto transformer to reduce the voltage to one half its present value for use across the bulb.

To make the outage of both lamps less frequent when these are connected in series both lamps should be of the same size, voltage, manufacture and age.—E.B.

Compound Motors As Generators

QUESTION G23—We have a great many surplus 50 hp 850 rpm 230 volt compound wound direct current motors at our plant. Would it be possible to convert these machines to use as welding generators to be driven by ac motors?—W.P.R.

ANSWER TO G23—To function satisfactorily as a welding generator a machine must have a no-load voltage of about 60 volts and be differentially compounded so that the voltage drops almost to zero at full load. It must also have enough built-in inductance to maintain a steady arc. Coarse control is usually accomplished by tapping out part of the series field; and varying the main field rheostat gives fine control. Conversion of your machines is not likely to prove satisfactory but it is suggested that you test one unit after making the following changes.

Assuming that this motor is a typical four pole machine the main field connections should be changed so that the fields are connected in parallel instead of series. If the generator is then belt-driven at about 250 rpm the no-load voltage will be about 60 volts. Make certain that the machine is driven in the correct direction so that no sparking occurs under load.

Next reverse the series field connections so that the generator is differentially compounded. A reactor must be inserted in series with one of the lines to the work because without the reactor it would be extremely difficult to strike and hold an arc. A small amount of control can be obtained by using a rheostat in the main field circuit. The generator is now ready to be tried for welding.

If satisfactory results are not obtained using the method described above the final change would be to rewind the complete unit. Besides being very expensive you still would have a welding generator in a 50 hp frame that would be unsatisfactory for continuous duty above approximately 200 amperes. The reason for this is that the commutator and brush assembly are not designed for a higher amperage rating.—H.G.C.

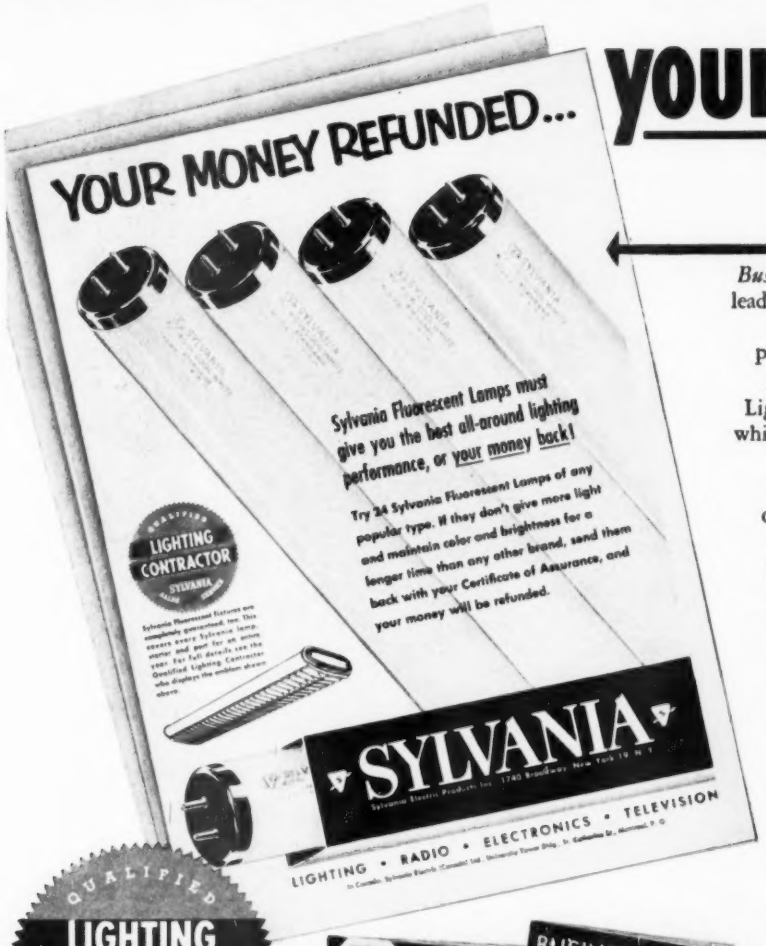
Pressure Switch

QUESTION H23—What would be a safe way to use a pressure control on a cone crusher with forced oil feed? I would like to maintain a constant oil pressure, and in case the pressure falls a few pounds, it should stop the crusher and give a signal.—E.H.

ANSWER TO H23—Adding a pressure switch, which can be set for any pressure 0-18 pounds, to the pressure side of the oil pump, will solve the problem. The pressure switch contacts are in series with the coil of a magnetic starter. The alarm can be set up with a 6 volt bell and transformer or batteries and switch to shut off the bell when the machine is shut down. A set of points must be added to the pressure switch so that when the contact is in open position the bell circuit is closed.—G.S.B.

ANSWER TO H23—If Mr. E. H. will look on page 161 under "Product News" of the March issue (1953) of

See how SYLVANIA backs up your business!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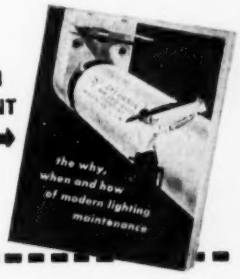

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Electrical Construction and Maintenance, he will find a vacuum switch described which I believe will meet his needs. The manufacturer lists this switch as being suitable for 2 hp motors on ac circuits and for ½ hp motors on dc circuits. If used in series with the holding coil on a motor starter, it could probably be used on a much larger motor. If this switch is unsuitable for his needs, I would suggest a mercury switch in series with the holding coil and actuated by the direct pressure of the oil line.—W.R.S.

Stripping Motors

QUESTION J23—What is the most simple and economical method of stripping motors?—L.W.F.

ANSWER TO J23—I have found that the most simple method of stripping motors is to use a sharp chisel on the end coils, then apply enough heat to free the coil and pull out from the opposite side. The use of an open flame to burn out all the insulation causes some damage to the core laminations, and makes cleaning more difficult.—E.S.H.

ANSWER TO J23—We have tried almost every method we have heard about and believe that burning is still the easiest and most economical way.

We burn out the frame over a large gas burner until all of the insulation is burned out or charred and the wire is soft. Then we cut all of the coils on one side with an aviation snips and pull them out the other side with pliers. All of the loose debris is then blown out with compressed air.

Anything remaining in the slots is cleaned out by hand with a hacksaw blade or screwdriver. However, only about one motor out of every eight or ten has to be cleaned out by hand.—H.G.C.

ANSWER TO J23—In this operation when band wires must be removed, they should be cut or filed in several places. When a chisel and hammer are used, care must be exercised not to mash down the armature teeth. The next step is to unsolder the leads to the commutator and clean out the slits in the commutator necks carefully. By pulling out to the top sides of the proper number of coils according to the throw, the bottom sides can be reached and will allow the coils to be removed easily.

After the coils have been removed the old insulation must be thoroughly taken off the core and the slots. Make a solution composed of 25% alcohol and 75% benzole. This solution is good

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for loosening the varnish of old insulation so that it can be scraped from the slots in the armature. This will produce no bad effects on the limitation or on the winding when the armature is rewound. A tool made from bar steel one by one-sixteenth inch of suitable length and drawn down to a long thin point like a chisel answers very well to remove old insulation after it has been softened, and will also give very satisfactory results without the use of any chemicals whatever. After removing the insulation in this way, a file down through the slots will remove small pieces of insulation and smooth off all roughness. The edges of the slots should be filed to remove sharp edges and burrs that would injure the new coils while being placed in the slots. The entire core should then be thoroughly cleaned with a blast of compressed air.—F.D.L.

Can you ANSWER these QUESTIONS?

QUESTION T23—In the process of refining transformer oil, I have used the press on energized 2300 volt transformers. Would it be advisable to do this cleaning process on 23,000 volt energized transformers? Oil is taken at the bottom, passed through a filter press and pumped to the top opening. Would there be danger of moisture in cleaning on the high voltage transformers?—E.S.H.

QUESTION U23—Some motor repair shops rewind motors with silicone insulation and claim they can make a 50 hp motor do the work of a 75 hp motor. In a case such as this how does that affect the efficiency, slip, power factor and mechanical strain on the motor?—M.D.

QUESTION V23—In our power plant we have an old 200 hp 250 volt, 650 rpm dc motor. Could we drive this machine at 1200 rpm to secure 500 volts output?—W.P.R.

QUESTION W23—We have many old rheostats lying around which are still in good condition. I want to connect these together in a tandem mounting to control the speed of a 5 hp, 220 volt slip ring motor. How do I determine the resistance and maximum current of the rheostat needed?—H.G.C.

PLEASE SEND IN

YOUR ANSWERS BY JULY 15

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Questions on the Code

Answered by

B. A. McDONALD, *New York Board of Fire Underwriters, Rochester, N. Y.*
GLENN ROWELL, *Electrical Engineer, Fire Underwriters Inspection Bureau, Minneapolis, Minn.*
B. Z. SEGALL, *Consulting Electrical Engineer, New Orleans, La.*

Flexible Conduit

Q. *We are installing a number of gas-fired unit heaters suspended from the ceiling in a manufacturing plant here and had planned to use a short length of ⅜-inch flexible conduit between the outlet box and the fan motor on each unit heater. Now we understand the Code forbids the use of any flexible conduit smaller than ½-inch trade dimension and we are unable to understand this as we have seen numerous installations where the smaller conduit has been used. Is it true that this is prohibited by the Code?*—S.L.L.

A. The National Electrical Code is rather definite in its statement that no flexible metal conduit or any other metallic raceway less than ½ inch trade size shall be used for general field application. You will find under Section 3503 of the Code special permission to use ⅜-inch flexible conduit for connections not over 48 inches in length to equipment where the use of the ½-inch or larger size flexible metal conduit is not practicable. You will also note permission to use longer lengths on approved assemblies, but for work done in the field it is necessary that the limitation of 48 inches be adhered to and then only when it is not practical to use a larger size of raceway. Therefore, for your unit heaters in question, if the fan motor housing is designed to take only the ⅜-inch connector and if the length of flexible conduit necessary is 48 inches or less, I would see no reason for not accepting the smaller size conduit.—G.R.

Service Cable for Water Heaters

Q. *According to Article 338, Section 3382, starting on the fourth line reads as follows: "but if without individual insulation on the grounded conductor may be used only for range and domestic water heater circuits. . . ."*

"C—No domestic water heater is supplied through a conductor without individual insulation."

I would greatly appreciate it if you would give me an interpretation of the Code on this section..—E.C.H.

A. As pointed out in your letter, Section 3382 recognizes the use of service entrance cable without individual insulation on the grounded conductor for a circuit supplying a water heater but paragraph C of the same rule practically nullifies this permission. This rule first appeared in the 1946 Code and was the source of considerable discussion. The sponsors at that time desired to include under Section 3382 permission to use a bare neutral for water heater circuits, the same as recognized for ranges. The opposition refused to agree. As a result the present wording is, to a degree, a compromise.

In line with the present wording, you could not, in my opinion, use a service entrance cable to supply a water heater unless all of the conductors feeding the heater are fully insulated. You could, however, run a 3 wire S.E. cable, with a covered neutral to a 2 wire, 220 volt heater and use the two fully insulated conductors for the circuit and the third wire, not insulated, could be used for grounding the frame of the heater or not used at all. A question has arisen about the disposition of the ends of the grounded conductor when not in use but the Code has not as yet ruled on this point.

As a result of the foregoing, the present rules for S. E. cable use are to a considerable degree conflicting and if we wish to avoid confusion with respect to intent, they should be revised to clearly cover what is intended.—B.A.McD.

Location of Meter and Switch for Gasoline Plant

Q. *We are having quite a heated controversy in our town concerning the location of a meter and disconnecting switch for use at a gasoline bulk plant. The representative of the oil company who supplies this small bulk plant insists it may be placed on the outside of the pump house which pumps the gasoline from the railroad tank cars into the storage tanks and from the storage tanks into the transport truck. I note in the Code that for gasoline dispensing in service stations it is required that ordinary equipment be at least 20-ft. horizontally and 5-ft. vertically from the gasoline dispensing pumps, but under that section of the Code pertaining to bulk storage plants, all I can find is the requirement that the outside wiring and equipment be more than 15-ft. above the ground level unless it is of the explosion-proof type and no statement is made as to the horizontal distance ordinary equipment may be located from any possible source of gasoline vapors. However, it does not seem to be good sense to permit the installation of a conventional switch and meter on the outside of a small pump house in which gasoline is handled. Could you explain why a horizontal distance has not been provided for these bulk storage plants?* —E.M.K.

A. I am unable to explain why the 1951 Edition of the National Electrical Code does not define a definite horizontal distance for bulk storage plants when it does define one for gasoline dispensing stations. However, this is being taken care of in the 1953 Edition of the Code, which will soon be available and you will note under Section 5125 of the new Code that this distance is defined as 25-ft. horizontally and 15-ft. vertically. This new section will be worded as follows:

"In outdoor locations, areas adjacent to loading racks or platforms, or to aboveground tanks, shall be considered as Class 1, Division 2 locations. Such areas shall be considered to extend 25 feet horizontally from such racks or tanks and upward from adjacent ground level to a height of 15 feet unless the Code enforcing authority judges otherwise."—G.R.

3 Phase-4 Wire Change Over

Q. *Shown on the next page is a portion of the "Electrical Plot Plan" of a proposed installation.*

There is, as indicated, an existing power and existing lighting cable buried in the same trench at distances

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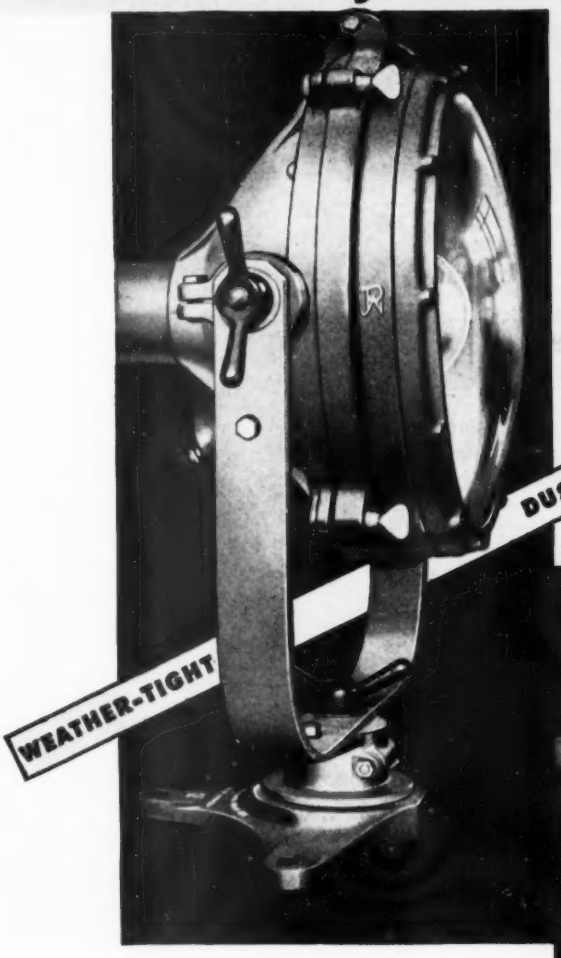

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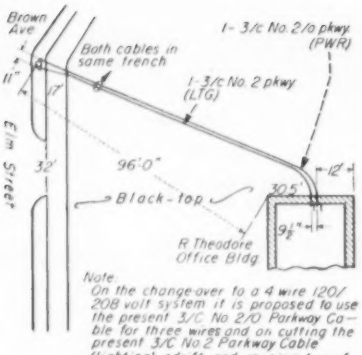

Brown Ave
Both cables in same trench
1-3/c No 2/0 pkwy (PWR)
1-3/c No 2 pkwy (LTG)
11"
11'
Elm Street
32'
96'-0"
Black-top
30.5'
12"
9½"
R Theodore Office Bldg
Note
On the change over to a 4 wire 120/208 volt system it is proposed to use the present 3/C No 2/0 Parkway Cable for three wires and on cutting the present 3/C No 2 Parkway Cable (lighting) adrift and reusing two of the 3/C for the fourth wire.

noted. We have been unable to discover a section in the NEC dealing with this problem. Would you please give us a ruling on the subject?—J.W.M.

A. If the parkway cable has an armored covering, there would be a violation of Section 3018 of the N. E. Code. This section requires the conductors of alternating current circuits to be so arranged as to avoid overheating of the metal by induction. With the 3 phase conductors in one cable and the grounded neutral in the other cable, the inductive effect on conductors of this size could be considerable. If the Parkway cable is not metal armored, there would be no violation of this Section of the Code.

Section 3105 of the Code, covering the use of conductors in multiple, is also involved with the proposal. This Section limits the use of conductors in multiple to sizes one naught to 500,000 c m inclusive, except where special permission is given by the authority enforcing the Code to do otherwise. In addition to the above requirements, I also believe that the insulation resistance of the old cables should be measured in line with the provisions of Section 1119.

As a result of the foregoing, it is my opinion that your proposal would be acceptable if the parkway cable was of non-metallic construction; its insulation resistance was satisfactory; and special permission, as defined by the Code, was obtained to run two No. 2 conductors in parallel.—B.A.McD.

Insulated Bushings

Q. *Does Section 3736b require an insulated bushing or securely fixed substantial insulating material to be installed with EMT containing No. 4 conductors or larger?*—J.P.

A. The rule as written in this section seems to require the use of either type of insulated protection for any type of raceway containing conductors No. 4 or larger. Thus EMT, greenfield, ovalduct or any such metallic raceway would have to be provided with an insulated bushing or insulating material.—B.Z.S.

More On Threading Of Conduit, Fittings, Etc.

The following is an interesting engineering analysis presenting another viewpoint in this discussion of Tapered vs Straight threads. The Adalet Manufacturing Co has requested that I comment on this discussion that they have prepared based on the threading problem as I discussed it in the January 1953 issue of *Electrical Construction and Maintenance*. I am pleased to submit herewith their discussion in toto as I feel that like so many engineering problems there is usually no one answer to cover each and every condition to be encountered. I would like to have any other comments on this analysis and I feel sure the Adalet people would appreciate getting other reactions to this discussion.

"Referring to the 'Questions on the Code' section of the January 1953 issue of *Electrical Construction and Maintenance*, dealing with conduit fittings and tapered threads, there seems to be general lack of appreciation of the yielding properties of structural materials under load.

"To varying extent, in different metals, two parts assembled by threading will deform and will more or less 'give' to accommodate each other, the female member stretching and the male member being compressed. If two such members are assembled with identical tapers on the threads, they abruptly come together and very heavy wrench forces are required to go beyond that point. On the other hand, if a taper male member is screwed into a straight threaded female member, there is a point where the two come to engagement (at the extreme end of the female and midway on the taper of the male), but at this point a further modest wrench force will permit additional rotation, the force building up as both parts are strained.

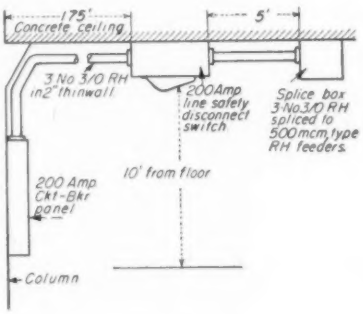
"Along with this there is an increased number of threads in firm contact. The female fitting tending to bell outward and male fitting deforming inwardly at the point of contact. The amount of rotation after engagement with this combination is far beyond that which could be obtained with the double taper combination, for the same wrench torque. In effect, the end result is practically a double taper fit which is nearly perfect because of the limited area in contact, all of which assures rigidity and an excellent ground.

"Straight and taper combination also makes it easier to wind up fittings to correct alignment without any necessity for 'backing up' with all its hazards. There seems to be no logical reason to use a combination which would invite the mechanic to back up a fitting when he could, with ease, turn it on around to a firm fit.

The above would seem to warrant further consideration of this entire problem of specifying double taper combinations."—B.Z.S.

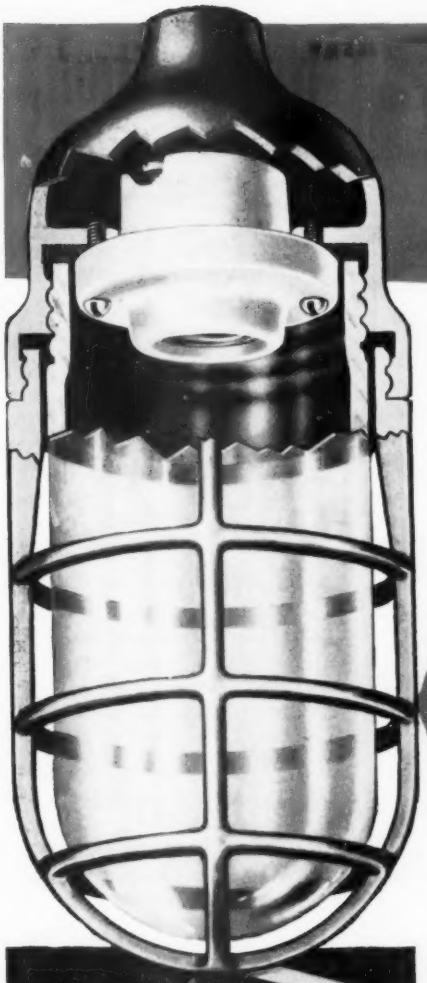
Switches on Ceilings

Q. *Does the Code permit installing a safety switch on the ceiling as shown in the illustration? It is impractical (due to building structure and damage to switch) to install a safety switch at a level which would be accessible to a person of normal height. The Code permits the use of busduct with switches located at levels beyond ordinary reach. Your answer will be appreciated.*—P.P.G.


175'
Concrete ceiling
5'
3 No 3/0 RH in 2" thinwall
200 Amp line safety disconnect switch
Splice box 3 No 3/0 RH spliced to 500 mcm type RH feeders
10' from floor
200 Amp Ckt-Bkr panel
Column

A. Section 3808 of the Code requires switches, so far as practicable to be readily accessible. The definition of readily accessible requires quick access to the switch for operation, renewal of inspection without resort to ladders, chairs, etc. If the switch contains a fuse, Section 2438 requires mounting in a vertical position unless in individual instances, this is shown to be impracticable; and Section 2435-a requires the fuses to be readily accessible except as provided for busways in Section 3650. It is noticeable that when overcurrent devices are involved, consideration of practicability is not recognized. They must be readily accessible.

In view of the foregoing requirements, I believe a switch, without fuses, could be mounted on the ceiling as shown, if a readily accessible location was not available. If the switch contained fuses, it appears that there would be a violation of Section 2435-a.



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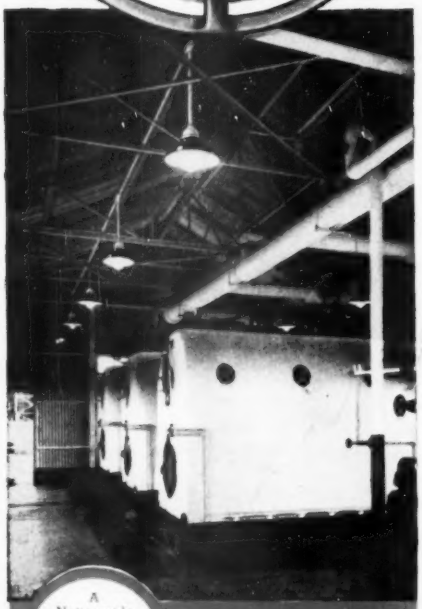
Industrial Lighting Fixtures

For use in boiler rooms, powerhouses, shower rooms, tunnels, loading docks, building entrances, and all indoor and outdoor locations where exposed to moisture and rain, non-explosive vapors and gases, or non-combustible dusts.

1. **Vaportight** and raintight.
2. **Wiring chamber** remains vaportight even though globe is *off*.
3. **Porcelain Receptacle.**
4. **Screw guard** or clamp guard.
5. **11 Hub** arrangements.
6. **4 Reflector** styles.
7. **Accessories:** Colored globes, pear-shaped globes and guards, half shades, and adapters.
8. **4 Sizes:** 50 through 500-Watt.



Vaportight lighting fixtures are available for attaching to several round-base Condulets and sheet steel outlet boxes. Crouse-Hinds complete *Vaportight* line includes hand lamps, switches, plug receptacles, and other electrical devices.

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Crouse-Hinds Company of Canada, Ltd., Toronto, Ont.

"What Is It?"

"What kind of blankety-blank wire is this, anyway?

"We took this coil off a job some time ago, stuck it in the store room, and now we want to use it again.

"But is it heavy enough to carry the load?"

"Send it down to Engineering to have somebody figure the wire gauge, somebody says.

"Great. Gotta be miked. Gotta look up the current-carrying capacity in a handbook. Gotta get it delivered back to me. Very practical suggestion . . .

"And then, what kind of jacket has it got?

"I suppose now somebody is going to tell me to send it out to a chemical laboratory to get it analyzed.

"Not me. I'm going to sit right down and write . . .

In connection with busways, an exception to the rule, it is noticeable that Section 3650 requires the fuses, when not readily accessible, to be closed or guarded until they are electrically disconnected from the busway. This requirement satisfies to a considerable extent the hazard involved.

Since the term "so far as practicable" as used in Section 3808, is difficult to define without a knowledge of all the details involved with the installation and in view of the varying conditions usually found on different applications, it is essential that this phrase be qualified by the local Inspection authority.—B.A.McD.

Switches

Q. *Will the Code permit the placing of six of the gang type single pole switches within a single standard 4-inch square outlet box that is 1½-inch in depth?*—M.K.B.

A. No, the Code limits the number of No. 14 conductors placed in a 1½-in. by 4-in. square box at 11 and it further states that the number of conductors shall be one less than that shown in the tables for each flush device or combination of flush devices mounted in the same strap. Therefore, if you placed six single pole switches in a single box, you would have to have at least 12 conductors, which would be two more than is permitted by the Code under Section 3709. Even though it is possible to obtain a cover plate having knockouts for up to six of these surface type devices designed to fit a 4-inch square box, the Code will not permit the simultaneous use of all of the devices unless the cover is placed on a deeper box.—G.R.

AC-DC Same Raceway

Q. *Is it permissable to install 2-24 volt No. 14 R signal wires, 2 No. 14 R—6 volt dc wires and 3 No. 14 R 220 volt 3 phase wires in one raceway if all the conductors are approved for 600 volts?*—P.P.G.

A. Section 30011 of the Code recognizes the use of conductors of different *light and power* systems in the same raceway provided the highest voltage involved does not exceed 600 volts and all conductors are insulated for the highest voltage involved.

Section 3011 prohibits the use of *signal* conductors in the same raceway with light and power conductors except as permitted in Section 7266 and 7292. Reference to Section 7292

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NUMBER OF CONDUCTORS—1, 2, 3, 4, 5, 6, 7, 8 . . .

THE SIZE—18, 16, 14, 12, 10, 8, 6, 4, 2, 1, 1/0, 2/0, 3/0, or 4/0

VOLTAGE—300V, 600V, etc.

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shows that conductors of a Class 2 signal circuit shall not be placed in any raceway with electric *light and power* circuits unless the conductors of the different systems are separated by a partition. This requirement does not apply to boxes and enclosures where a power supply is introduced solely for the purpose of supplying power to the signal equipment.

Section 7266 permits power conductors in the same enclosure or raceway with Class 1 system conductors only when such power conductors are used to supply equipment to which Class 1 system conductors are connected.

In view of the foregoing requirements, it appears that your proposal to run signal wires in the same raceway with a three phase 220 volt circuit, would be in violation of the Code. —B.A.McD.

Conductors in Wireway

Q. *We are wiring a new multicolor press in a newspaper plant and plan to use wireways to carry the motor circuit conductors to the motors on this press. We note the Code does not require the use of the correction factors specified in Note 4 following Table 1 for the determination of the carrying capacities of conductors in wireways, but our local inspector insists we use some correction factor unless we separate the conductors on racks within the wireway so not more than three conductors can be in close proximity with other conductors. Do you feel that he is correct in this request and if so, what correction factor would you recommend we use in a wireway where we will have 21 conductors varying in size from No. 7 to No. 14?*—K.M.

A. If the conductors are all to be laid in the bottom of a wireway, one on top another, I would recommend that you use not more than 70% of their normal carrying capactiy as shown in Table 1 as heat which cannot be readily dissipated or liberated into the atmosphere will accumulate until it brings about deterioration of the insulation on those conductors having the least amount of surface area exposed to the atmosphere. The carrying capacity of insulated wires is based entirely on the temperature at which a given amount of amperage causes that wire to operate and when wires are laid together within a conduit or a wireway or any other type of enclosure, the amount of heat they may dissipate from their exterior insulated surface depends entirely on the percentage of that surface which is exposed to air. Therefore, if you would follow the alternate

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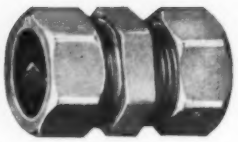

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suggestion made by your inspector of bundling each set of three conductors serving each motor and supporting it on a rack or pin within the wireway so there would be air separation between each set of three conductors, then you might safely use the carrying capacity figures shown in Table 1 of the National Electrical Code.—G.R.

Motors On Emergency Lighting Systems

Q. *Can a motor be operated off an emergency lighting service? For example could elevators be connected to an emergency lighting system fed from a 4 wire, 3 phase, 200 ampere emergency service if it were ample for this elevator load and the lighting load?—C.V.P.*

A. Section 7001 of the 1951 Code specifically states the provisions of Article 700 ". . . shall apply to systems or circuits for supplying emergency illumination only. . . ."

The need has been recognized for some time to provide "emergency service" rather than "emergency lighting" only, to buildings. A complete study has been made of the present Code Article 700 on "Emergency Lighting" and as a result a complete redraft has been proposed for inclusion in the 1953 Code.

This new Article entitled "Emergency System" recognizes the fact that other emergency services may be required in a building to protect life and property in the event the normal electrical facilities within the building fail. For example, it is most essential that certain equipment in hospitals be assured of continuous operation, viz., motors for iron lungs, sterilization equipment, operating equipment (much of which is now electrically equipped). In an office building it is most essential that some elevator service (and in some cases maybe all elevators should be considered) be maintained if normal power fails.

The explanatory note proposed in the new article in its opening section outlining the scope, covers this new concept. As written in the proposed third draft it reads:

"This article does not require the installation of emergency systems, but specifies the manner of their installation to fulfill their designed function in cases where emergency systems are required by other codes or agencies, or are voluntarily installed in the interest of safety to life and property.

Emergency systems are generally considered essential to places or assembly where artificial illumination is

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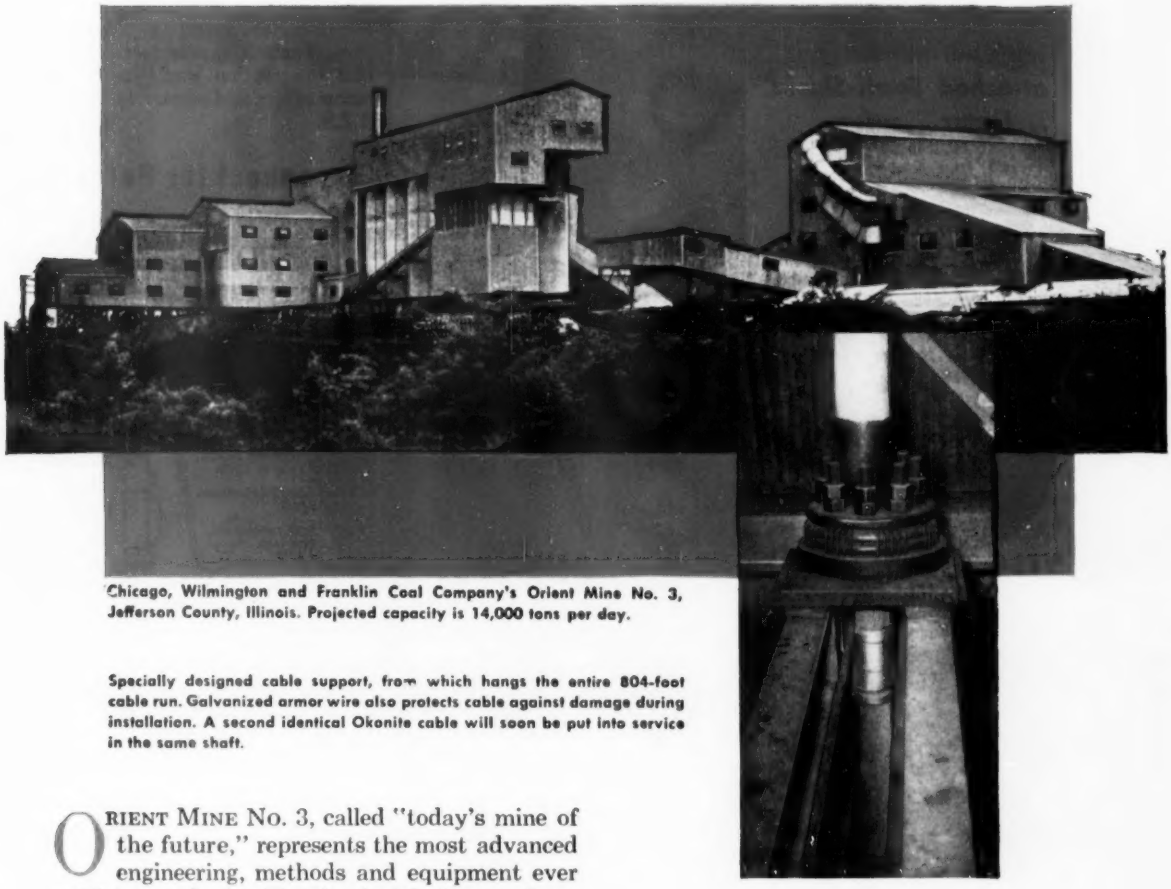

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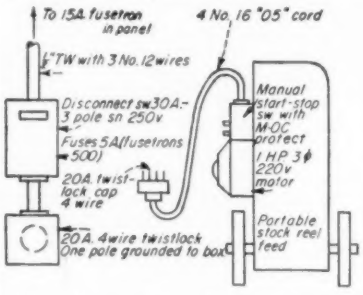
required such as buildings subject to occupancy by large numbers of persons, hotels, theatres, sports arenas, hospitals and similar institutions. In addition to lighting they may provide such functions as essential refrigeration, operation of mechanical breathing apparatus, ventilation when essential to maintain life, illumination and power for hospital operating rooms, fire pumps, industrial processes where current interruption would have serious consequences and similar functions."—B.Z.S.

Disconnect for Portables

Q. *Is it mandatory to use a disconnect as illustrated below? Is it mandatory to use a 4 wire cord—one wire (green) used to ground equipment or could a 3 wire cord be used with a separate fourth wire as*


To 15A fusetron in panel
4 No. 16 "05" cord
½" TW with 3 No. 12 wires
Disconnect sw 30A.-3 pole sn 250v
Fuses 5A (fusetrons 500)
20A. twist-lock cap 4 wire
Manual start-stop sw with M-OC protect
1 H.P. 3ϕ 220v motor
Portable stock reel feed
20A. 4 wire twistlock One pole grounded to box

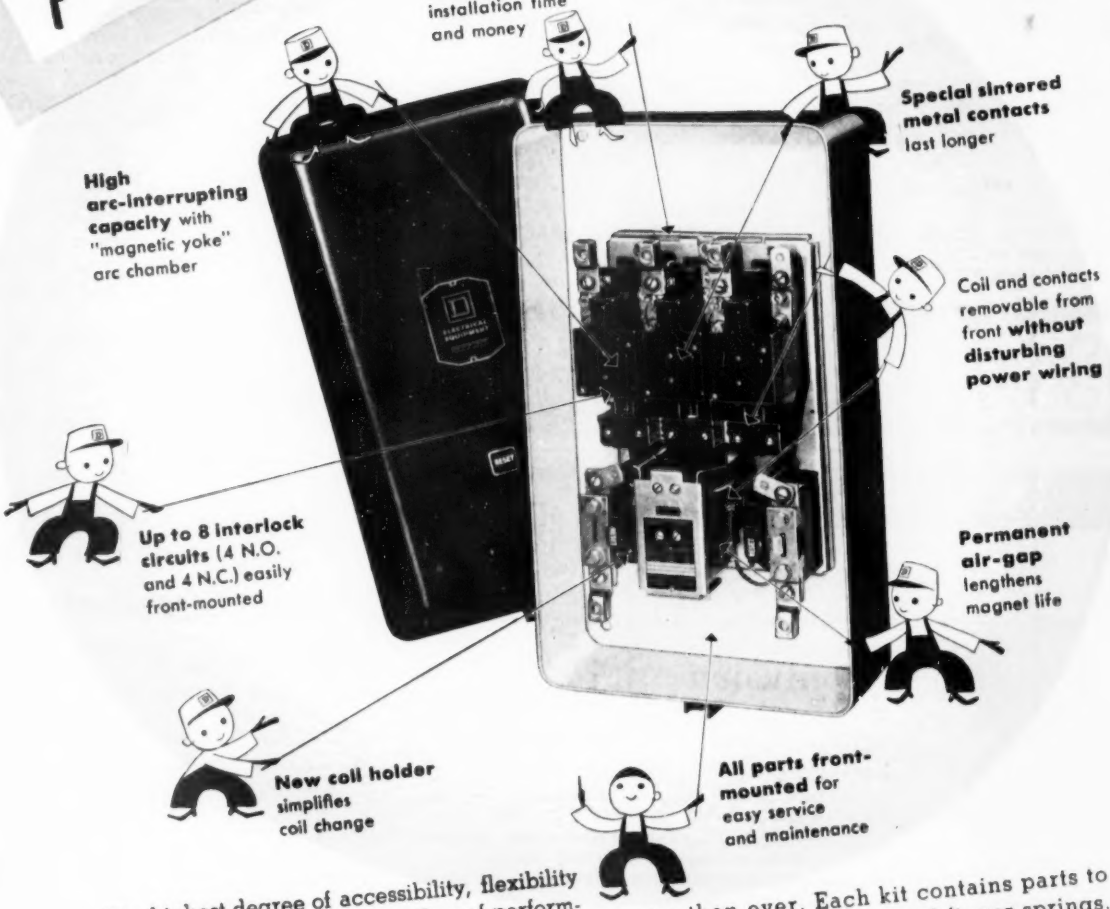
an equipment ground (separate wire would be stranded for flexibility)? The reason for the latter question is due to the fact that the existing equipment comes from the manufacturer with a 3 wire cap—no ground wire used. The system is 3 wire, 220 volt, 3 phase with "A" phase grounded making the potential to ground 220 volts.—P.P.G.

A. In answer to your first question, two Code rules are involved. The first one, Section 4383 requires the controller of a motor to have a hp rating not lower than the hp rating of the motor. One of the exceptions to this rule concerns portable motors, 1/3 hp or less, which may be controlled by an attachment plug and receptacle.

The second rule concerns the disconnecting means for a motor, covered by Section 4402 of the code, which in general requires a motor circuit switch, rated in hp or a circuit breaker, with some exceptions. One of the exceptions 4402-e recognizes the use of an attachment plug and receptacle as the disconnecting means of a portable motor, irrespective of the motor size.

In order to comply with both of these rules, the disconnect means may be an attachment plug and receptacle but the motor controller must have a hp rating when the motor is larger than 1/3 hp.

NEW Square D Size 4 Starter



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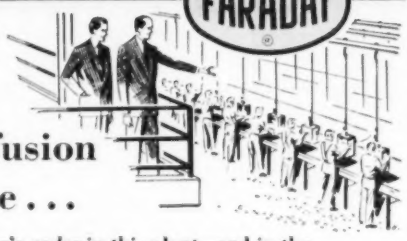

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In addition, the motor must have overcurrent protection as required, in your case, by Section 4322 b.

A review of these rules indicate to me that if the manual, Start-Stop switch with motor overcurrent protection, located on the portable has at least a 1 hp rating, the Code would not require the additional switch and overcurrent protection ahead of the receptacle as shown in your illustration.

In connection with the 4-wire cord, Section 2559 of the Code covers the grounding of portable equipment and recognizes as one of the three methods, Section 2559-c, a separate flexible wire or strap, insulated or bare, protected as well as practicable against mechanical injury. This present Code provision however has received considerable attention and it appears likely that the new 1953 Code will recognize such a method of grounding only by special permission except where a part of an approved portable equipment. As a result, the present Code would recognize a separate fourth wire for the equipment ground as covered by your question.

The most effective means of grounding a portable, however, would be obtained by the use of a 4 wire cord with a 4 wire receptacle and cap, as covered by Section 2559-b. The grounding conductor in this case, if insulated, must be finished to show a green color. Section 94003 and 94004 gives more detail on this point.—B.A.McD.

Service Conductors

Q. *On wiring farmstead properties, most R.E.A.'s that I have worked on have insisted on using a single raceway for the meter loop even though they mount below the meter a distribution panel and main line switch. Is this not a Code violation?*—O.C.S.

A. The correct answer to your question depends entirely on whether or not the installation is so designed that the meter loop and distribution equipment is considered service or simply a meter loop. Section 2306 of the National Electrical Code reads as follows:

"Conductors other than service conductors, grounding conductors, or control conductors from time switches having overcurrent protection, shall not be installed in the same service raceway."

In other words, where only a single raceway is used on the yard pole, the conductors serving the various buildings from that pole must still be considered service conductors while if a two raceway system were used, it

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ABC ARMORED CABLE

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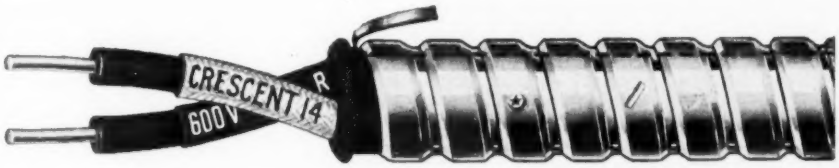
2 BREAK ARMOR

3 PULL OUT PAPER

4 INSERT INSULATING BUSHING



★ **NOTE CUTMARK** on the fourth turn from right on armor of cable above. This cutmark (at 1½" intervals) shows the location of a prefabricated breaking line inside the armor. Only a few strokes of a file or saw guided by the cutmark are required to cut through one outer ridge, and a bend by hand severs the armor. This results in a clean separation with no sharp edge—a safer, easier and faster job. The prefabricated breaking lines are so designed that there is *no reduction* in tensile strength, bending quality, crushing resistance and electrical conductivity of armor.

★ **NOTE BOND WIRE UNDER ARMOR** which is in contact with the under side of each convolution. This provides permanently low armor resistance. It is furnished in sizes No. 14 and 12 AWG Cable.

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CHELSEA

would be possible providing the conductors were properly protected with the right size of overcurrent protective devices in the distribution panel to consider those conductors servicing the other buildings as feeders and not as service conductors.

Experience in areas where lightning disturbances are prevalent indicates that the use of a single raceway or cable for both the incoming and individual building service conductors is a serious mistake and many R.E.A. Cooperatives are now swinging to the two stack service at the meter pole to lessen the lightning damage.—G.R.

Conductors in Service Raceway

Q. *I ran a new service for a home, 3 wire single phase in one inch heavy wall conduit, which is customary here, and had to run back up near the head to feed back in to an old part of the house from our new source which included RT CB, and put in a 30 amp CB unit along with the others and took this lead back out of the service conduit at the head, to feed an old fuse box to which the old wiring was run to. I protected the ground wire with a piece of ½ EMT. Well, they claim that this is contrary to NEC and we have been doing it here for a number of years and all of a sudden they come out with this ruling not in print, but by way of mouth, and I can't see where the 51 Code says a word about it.*

The power companies and the REA time after time run the incoming feeders to a meter and CB and right back up the same conduit to the load. The way I get it, this is permissible if conduit is sized to take the conductors that are installed in it. But they did not say a thing about the amount of conductors, merely you can't run a feed back wire through the service conduit, no matter what the size. So I pulled it out and ran a piece of half inch HW containing one conductor up to the wire that feeds into old service box, encased the ground wire with a piece of HW and that was it.—C.M.

A. As I understand your question, the main point of contention concerns the use of the service raceway for enclosing a feeder to the old part of the house in addition to the service entrance conductors.

Section 2306 of the N. E. Code, in my opinion, prohibits such a procedure. This rule reads as follows: "Conductors other than service conductors, grounding conductors or control conductors from time switches having overcurrent protection, shall

You have to go inside

Almost all cables look alike on the outside. You have to go inside the jacket to the insulation if you want to see how good the cable really is. In power cables it's the insulation that makes the difference. This fact may be borne out in years of service or as a result of rigorous laboratory tests.

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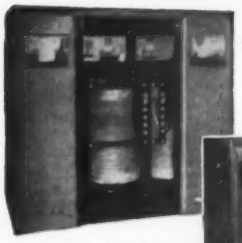

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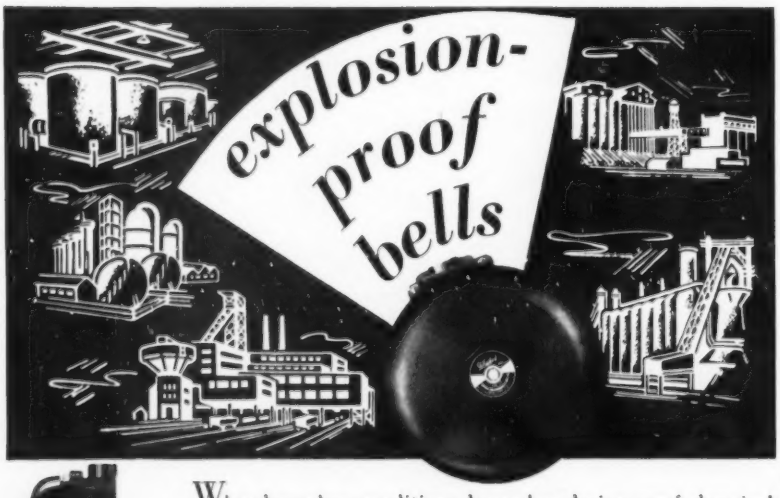

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not be installed in a service raceway." This requirement has been in the Code for more than 20 years with the exception of the recognition of control conductors which was added about 16 years ago.

On rural installations such as farm properties with several buildings to be served, some electric utilities promote the use of outside pole metering. On such installations the service wires to the meter are run in a conduit to the meter and return to the top of the pole through the same conduit. There is no violation with such an installation since all of the wires in the service raceway are service wires. Even though a switch also was installed with the meter on the pole, there appears to be no Code violation since the fine print note following Section 2304-b appears to sanction such a combination but advises that the conductors from the pole to the building served shall be considered as service drop conductors. In such cases, each building served must have its own service equipment.

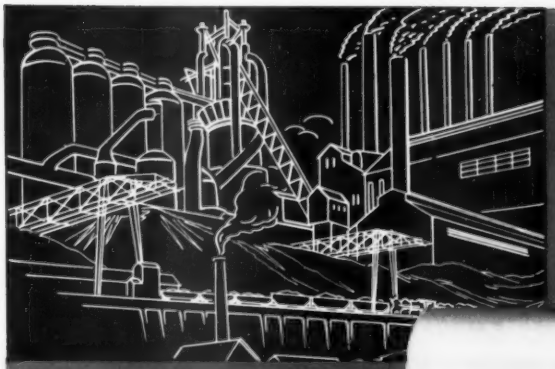
Section 2305-d of the Code also recognizes service conductors in a raceway running down the side of a building to an outside meter and then returning in the same raceway to connect to the service-entrance conductors of an existing installation.

I believe you will agree that none of these requirements cover your case which evidently violates the provisions of Section 2306. The method used to correct the condition also appears to be a violation since Section 3018 of the Code would not permit one wire of an ac circuit to be run in a metal raceway due to the resultant inductive effect.

In general, I would like to offer the following comment concerning Section 2306 of the Code. Service conductors are protected only by primary fuses or breakers. When a fault occurs they usually burn. They are subjected to most of the abnormal conditions which an outside distribution system experiences during wind and lightning storms. It is therefore essential that such conductors be isolated from other protected wiring on the premises if we wish to avoid a potential fire and personal injury hazard.—B.A.McD.

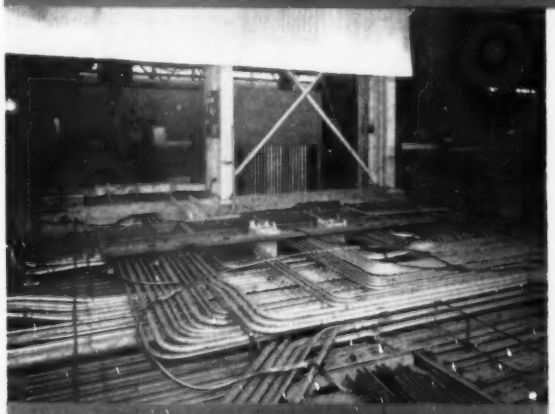
Fluorescent Fixtures

Q. *We have just completed the wiring of a large kitchen in an institutional type building and the local inspector has refused to accept the lighting installation used under the hoods over the cooking ranges where specifications call for tubular lighting. The inspector claims this is*



in a Pittsburgh steel mill....

112 Tons of SPANG® Central Conduit



Today's modern steel plants use tremendous quantities of electric power to operate the many complex steel producing and processing machines needed to keep up with demand for steel products.

Installations of this type require conduit that . . .

—offers years of trouble-free service in a permanent installation.

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There were two reasons for specifying Spang:

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Made from top-quality steel, Spang Central Conduit is carefully controlled under exacting conditions during forming and is thoroughly inspected to assure you of a reliable product with years of service life.

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Because of its quality-controlled manufacture, Spang Central Conduit offers such working advantages as easier bending, cutting and threading which saves time and money on installations.

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Easy to install. Economical. RLM lighting efficiency for low ceilings.

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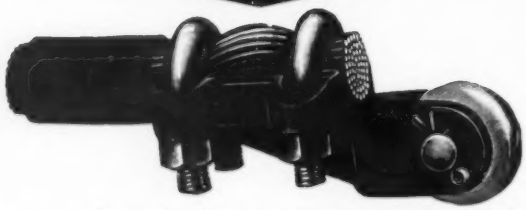

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Efficiency Cable Strain Clamps lock cable safely and securely without possible strain or damage. "H" construction of clamps and high ridge across center of cable prevents cable from slipping. Takes cable from 1/0 to 1,500,000 c.m. Three clamp sizes cover all cable sizes. Furnished with eye or clevis, for AC or DC service.

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contrary to Code, but we are unable to find any provision in the Code which would prohibit the use of a fluorescent lamp under this hood. Is this actually prohibited by the Code?—P.H.T.

A. Section 1110 of the National Electrical Code does state that unless approved for the purpose, no conductors or equipment shall be located in a damp or wet location or where exposed to gases, fumes, vapors, liquids or other agents having a deteriorating effect on the conductors or equipment. Then under the National Standards governing the installation of ventilation over restaurant type cooking equipment, you will find under Section 532 the added requirement that all electrical equipment including lighting fixtures shall be installed in accordance with the National Electrical Code with due regard to the effects of fumes and grease on that equipment located in the hood or otherwise in the path of the fume travel. As grease, vapors and heat may have a deteriorating effect upon ordinary electrical insulation, excessive deposits on electrical fixtures and devices tend to increase operating temperatures above normal. It is therefore necessary either to use vaportight types of electrical equipment or to provide illumination through suitable wire glass panels in the hood.—G.R.

Armored Cable

Q. *Please give us your interpretation of Section 3344, Exposed Work. If armored cable is run exposed on surface of a wall to within four feet of floor, does the code consider this subject to mechanical injury and does it require protection up to within seven feet of the floor?*—H.D.G.

A. Your question is one which has been an inspector headache for many years.

Some inspectors would interpret the code as requiring the additional protection, others would say the armor itself offers sufficient protection.

You must first determine whether or not it is subject to mechanical injury. Here again you will find divergent opinions between inspectors. I venture to say that on the same job you will have several inspectors disagree. And in all probability each inspector will be right since in his own experiences he has accumulated enough facts to substantiate his ruling.

So in your case an answer can only be given when all facts are specified and actually known. In some cases you will need additional protection, in others will not.—B.Z.S.

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Doubling the life of your electrical equipment means money in your pocket.

That's why you should investigate this revolutionary new development. It reduces down-time, prevents unnecessary work stoppages, eliminates unnecessary idle man-hours. SAFE-T-SEAL is particularly economical and profitable where *tough* operating conditions prevail.

What SAFE-T-SEAL Is. SAFE-T-SEAL is *not insulation* in the generally accepted sense. In itself, it has no appreciable dielectric strength. Operating on an entirely new principle, called "molecutronic" action, it neutralizes the effect of the "paths of least resistance" when they come in contact with a conductor processed with SAFE-T-SEAL. It is used *in addition to* normal insulating materials and varnishes, fortifying them, prolonging their life and affording protection against the destructive effects of severe operating conditions normally present in many industries.

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Safe-T-Seal applied to equipment at 160° F, by immersion, low pressure spray, pouring or brushing, dries at room temperature and remains effective for long periods of time regardless of extreme temperature changes. Application may be made in your own shops, or through the facilities of your nearest Authorized Safe-T-Seal Motor Repair Shop.

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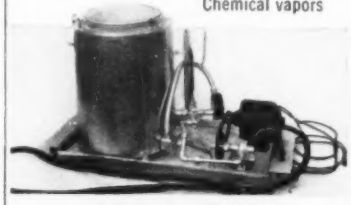


Handy Portable Dispenser

The pressure-spray dispenser illustrated is available for industrial electrical maintenance departments and independent motor repair shops at nominal cost. Efficiently designed, works smoothly...saves time, man-hours. Fully portable on ball-bearing casters. Easy to use. Permits economical use of SAFE-T-SEAL...at required temperature.

Motor Shops

Shop In-Line Rack Pays Out Magnet Wire

Constant handling of large wire reels eliminated at Spaulding Electric Company

Coil winders in the motor repair shop at Spaulding Electric Company, Detroit, need not spend valuable time locating and setting up magnet wire reels each time a set of coils has to be made. Sixteen reels of the eight most popular wire sizes (two reels of each) are combined with a long pay-out rack to keep wire available and ready for immediate use at all times. Reels lie on their sides in two parallel rows on a plywood platform at the base of the floor-mounted rack. Each reel has its own de-reeling mechanism.

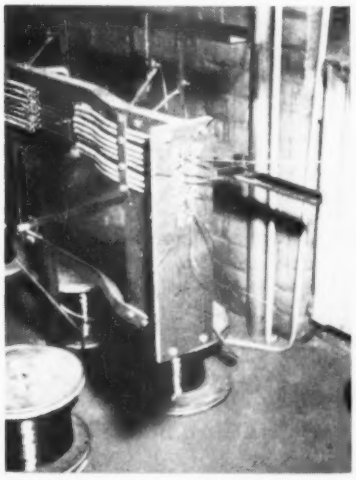
DE-REELING AND PAYOUT RACK keeps 16 or more reels of magnet wire ready for immediate use in coil winding department. Normally, two reels of each size are placed on rack. Wire passes through de-reeling tube and raceway guides to terminal block.

Four sturdy pipe pedestals with steel channel cross-arms support the 15-ft., 8-in. channel and angle-iron rack. A full-length, ladder-type frame on the left side of the rack (see photo) supports eight bearing pillow blocks for the de-reeling tubes. Mounted to the vertical cross pieces are parallel groups of small diameter metal tubing raceways which guide the individual wires to the pay-out block at the head of the assembly. The other half of the rack is of somewhat similar design and supports the second group of bearing pillow-blocks and transverse wire guides. Raceway tubing is mounted in sectional groups with open spaces between to facilitate threading of the magnet wire along the length of the rack. A removable steel rod at the head of the rack supports two additional reels if necessary.

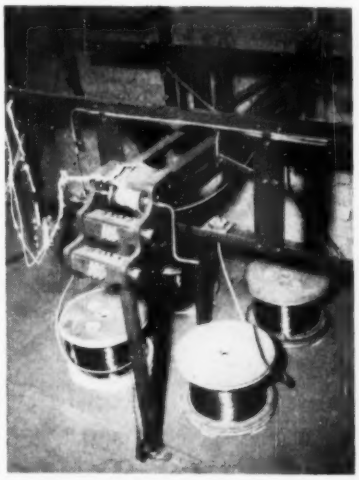
The simple de-reeling device at each reel consists of a section of metal tube shaped like a splayed-S and mounted to the pillow-block bearing. The magnet wire passes through this de-reeling tube and the guide raceways to the terminal block. As the wire is wound around the coil forms, the S-shaped tube rotates around the reel and pays out the wire without snagging.

Two vertical rows of openings (10 per row) in the rectangular, fiber, terminal block accommodate the flared ends of the wire guide tubes. Wire size is stamped at the side of the respective tubes for easy identification. No. 14 magnet wire extends out of the two top openings; No. 15 out of the two below; and so on down through 16, 17, 18, 19 and 20. The rest of the openings are spares.

Near the rear of the pay-out rack is a pedestal-mounted, steel tension block for rectangular conductors. The wire is stored on the floor above, passes down a conduit raceway on the wall, makes a right angle turn around a special pulley and guide shield at the conduit terminus, and crosses the pay-out rack to the tension block. This simple arrangement eliminates the necessity of transporting large coils down to the winding area. Combination of these two devices permits efficient handling of magnet wire for coil winding requirements.



FIBER BLOCK at head of rack is terminus for twenty metal guide tubes. Wire size stamped on block beside respective tubes provides easy identification for winder.



TENSION BLOCK on pedestal at rear of rack is for rectangular wire stored on floor above. Wire comes down conduit raceway on wall and crosses wire payout rack.

WALL PULLEY AND SHIELD guides rectangular wire around 90° bend to tension block on opposite side of rack, making it available for immediate use.

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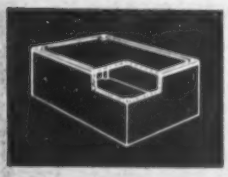

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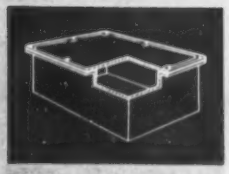

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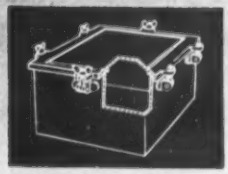

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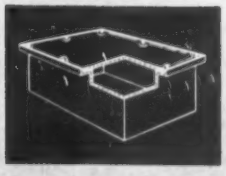

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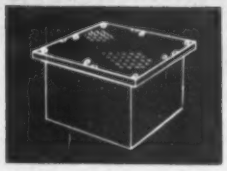

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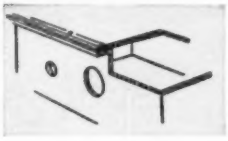
of conduit entrances



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to provide extra thickness
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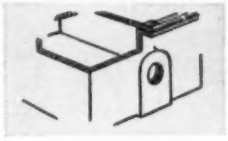

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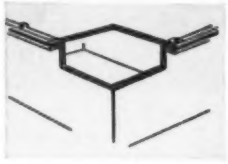

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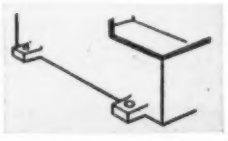

INTERIOR MOUNTING BUTTONS—
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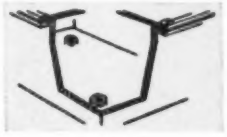
to specified centers



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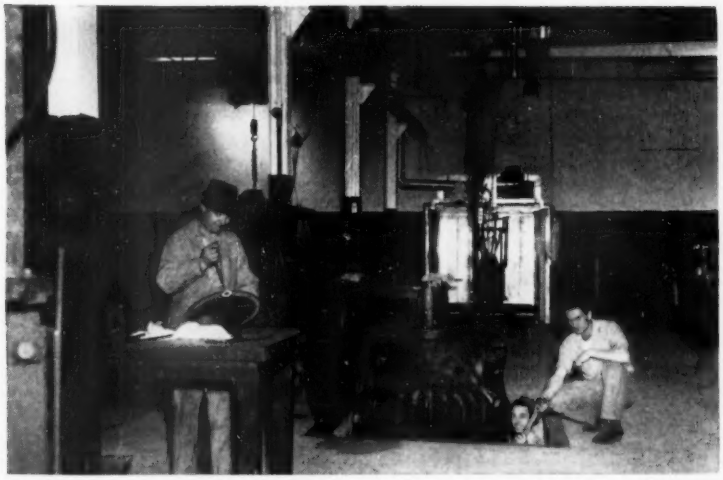


BY LOWERING TRANSFORMER into floor pit, added headroom is gained and overhead crane can pull coils that could not be lifted clear of the case under conditions of normal shop construction.

NEVER IN A LATHER is the shopman who uses this work table constructed on the base of a discarded barber chair.

Floor Pit Creates Greater Headroom

When large transformers are brought into the Electric Motor & Repair Company's Raleigh (N.C.) shop, they are lowered into a floor pit before core and coils are pulled. The pit measures 6-by-6-by-6 feet and is covered when not in use by a sheet steel cover. With the transformer resting in the pit rather than on the floor of the shop, an additional 6 feet of headroom is available and the overhead crane can be used to lift coils that could not be drawn from the case otherwise. By constructing this small pit for large-unit servicing, rather than raising the roof of the entire shop, both construction and heating costs were reduced. It also places the top of the case at a convenient working level.

Barber Chair Makes Adjustable Work Bench

The raising, lowering and rotating features of a junked barber's chair were usefully adapted in the construction of a useful work bench for the Warwood Armature Repair Company shop in Wheeling, W. Va.

As indicated in the accompanying picture, the operator can adjust the table to the most convenient working height and can rotate the table or lock it into a fixed position by a lever.

The working surface consists of a 3-foot disc of ½-inch steel, supported by four sturdy legs which slant inward to the normal chair base and are welded to the working surface. To provide insulation and a non-slip surface, the steel deck can be covered either with leather belting or rubber sheeting.

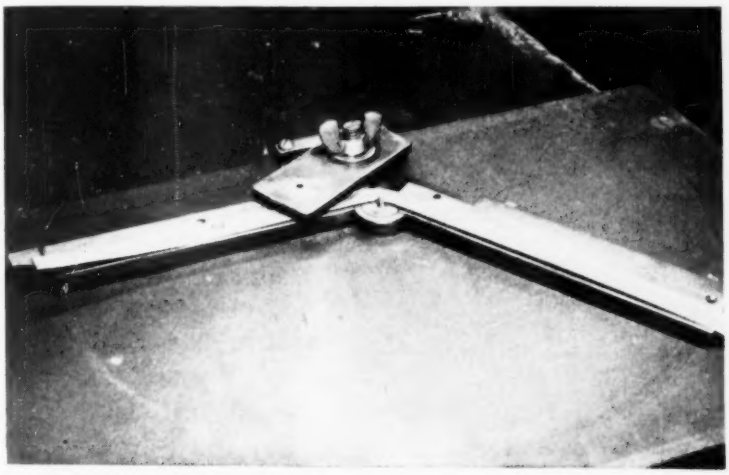
Hand Bender for Flat Copper Coils

Forming hairpin bends in flat copper coils is a simple and easy operation at the Owen Gollar Electric Company motor repair shop in Louisville, Kentucky. Shop personnel made it so by designing and building an efficient bench-type hand bender for the rectangular copper conductor.

Base of the unit is ¼ inch steel plate, 16 inches long and 10 inches wide, bolted to two angle-iron (1½ inch) supporting "rails". The actual bending mechanism consists of two 6½-inch lengths of 1 in. by ⅜ in. tool steel bar pin-hinged at the center. One bar is bolted to the steel base, the other is free to rotate 180° in the horizontal plane. The pin at the hinge projects above the bars to form a fulcrum about which the copper is bent edgewise. A groove, of proper width and depth to "seat" the 0.400 by 0.045 copper, is milled the full length of both bars.

When the two arms of the bender are in a straight line, the hinge-pin is flush with the inside edge of the groove. The copper stock is placed in the groove and held securely by a thumb-screw clamp. One end of the clamp-plate has a hole which fits over the hinge-pin; the other rests on a spacer bar of the same thickness as the arm (⅜-inch). End clamps could be added if desired.

After the copper is clamped in the unit, the bending arm is rotated 180° to form the hairpin bend. A long handle extension on this arm provides the necessary leverage. When the bend has been completed, the clamp is released and the coil removed.

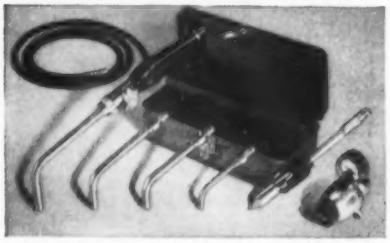


SIMPLE HAND BENDER on bench forms accurate hairpin turns in flat copper conductor. Thumb-screw clamp prevents copper from jumping out of groove at fulcrum point.

HANDY IN TIGHT SPOTS!

Prest-O-Lite
Trade-Mark

5-in-1 OUTFIT



PREST-O-LITE *Torches average less than 12 in. long, weigh under 13 ounces. Precisely controlled flame heats only the work.*

With the four different sized stems and soldering iron in this outfit, you can handle any job from the heaviest soldering down to finest instrument work. The stems and soldering iron are instantly interchangeable on a common handle. No wrench is needed. Every assembly is small, compact, light, and easy to handle in any location. See your LINDE Jobber today for details. Or write LINDE AIR PRODUCTS COMPANY, a Division of Union Carbide and Carbon Corporation, 30 East 42nd Street, New York 17, N. Y. In Canada: Dominion Oxygen Company, Limited, Toronto.

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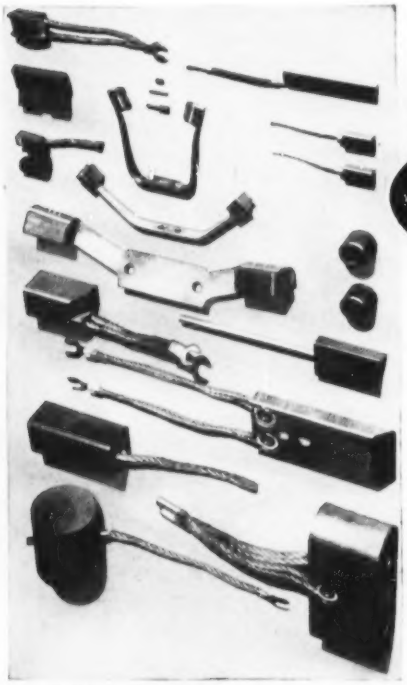

"Odd Fellows?"

Do you sometimes need quick service on an unusual job? Might the answer be in one or more of the brushes pictured here? *Safe rule . . . call your Superior distributor first.* We have made just about *"every brush in the books"*. Odd brushes — *"odd fellows"*, if you like — present no problem.

Since 1919 **Superior** CARBON BRUSHES

SUPERIOR CARBON PRODUCTS, INC.
9112 GEORGE AVENUE
CLEVELAND 5, OHIO

WOODEN FENCE around open shaft and trap door which is lowered over the opening when motors are not being raised or lowered are safety measures found in the Allentown, Pa., shop of H. N. Crowder Jr.

Hoistway Guarded By Fence and Trap Door

Inasmuch as the building occupied by H. N. Crowder Jr. in Allentown, Pa., is located on a steep hill, the shipping and receiving entrance (at the side towards the rear of the building) is on a lower level than the front entrance and main shop area. To raise motors from the receiving to the repair floors, therefore, an electric hoist has been installed. This hoist runs along a monorail on the shop ceiling, one end of which is located above a shaft covered by a trap door.

This door, counterbalanced, is easily raised to permit passage of motors, yet is kept closed when not in use. Likewise, to safeguard employees, the shaft is surrounded by a thigh-high wooden fence.

After motors have been raised to the shop area, they may be moved laterally by the monorail-mounted hoist, then lowered in the checking and stripping centers. The hoist, when not in use, can be pushed along the rail so that the chains and controls fall behind the shaft fence line.

Triple-Unit Burn-Out Oven

Windings can be "burned-out" of three motors simultaneously in an oversize concrete oven designed and built in the motor repair division of Johnson-Turner Electric Repair and Engineering Co., Ltd., Windsor, Ontario, Canada. Motors up to 60 hp, 1800 rpm size can be lowered into the 8-foot by 4-foot by 40½-inch deep enclosure.

BULLDOG BUStribution DUCT

10 feet—or 10,000

You can use a single standard 10-foot section of BullDog Plug-in BUStribution DUCT to do the work of a switchboard, or purchase any desired length to provide flexible, plug-in power for lighting and other circuits.

You can add sections without limit. For this duct's absolute flexibility and salvability enables the BullDog Plug-in BUStribution DUCT System to grow or change as conditions require.

With BullDog Plug-in Duct, too, you are assured of maximum installation speed and economy, made possible by the exclusive BullDog scarf-lap joint. Sections clamp together smoothly, quickly, rigidly. Bulky, complicated, time-consuming joint fittings are eliminated.

For complete details, write BullDog Electric Products Company, Dept. EC63, Detroit 32, Michigan; or contact your BullDog Field Engineer—located in all principal cities.

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RIDGID means most service for your money!

Never before one so easy to carry—
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4P Geared
Conduit Threader

• If you've rassled with old-style geared threaders, you'll go strong for this RIDGID 4P. It's got balanced loop handles—a cinch to carry and to swing onto conduit. Mistake-proof workholder sets to size before it's put on conduit—only 1 screw to tighten. Easy upkeep—drive pinion in oilless bronze bearing; safe enclosed gear. 4 sets of 5 high-speed steel dies, 2½", 3", 3½", 4"; ratchet handle. RIDGID Universal Drive Shaft available. Buy work-saver 4P at your Supply House.

THE RIDGE TOOL COMPANY
ELYRIA, OHIO

RIDGID
Work-Saver Pipe Tools

OVERSIZE CONCRETE OVEN burns out stator windings, three at a time. Cover is constructed in two easy-to-open sections.

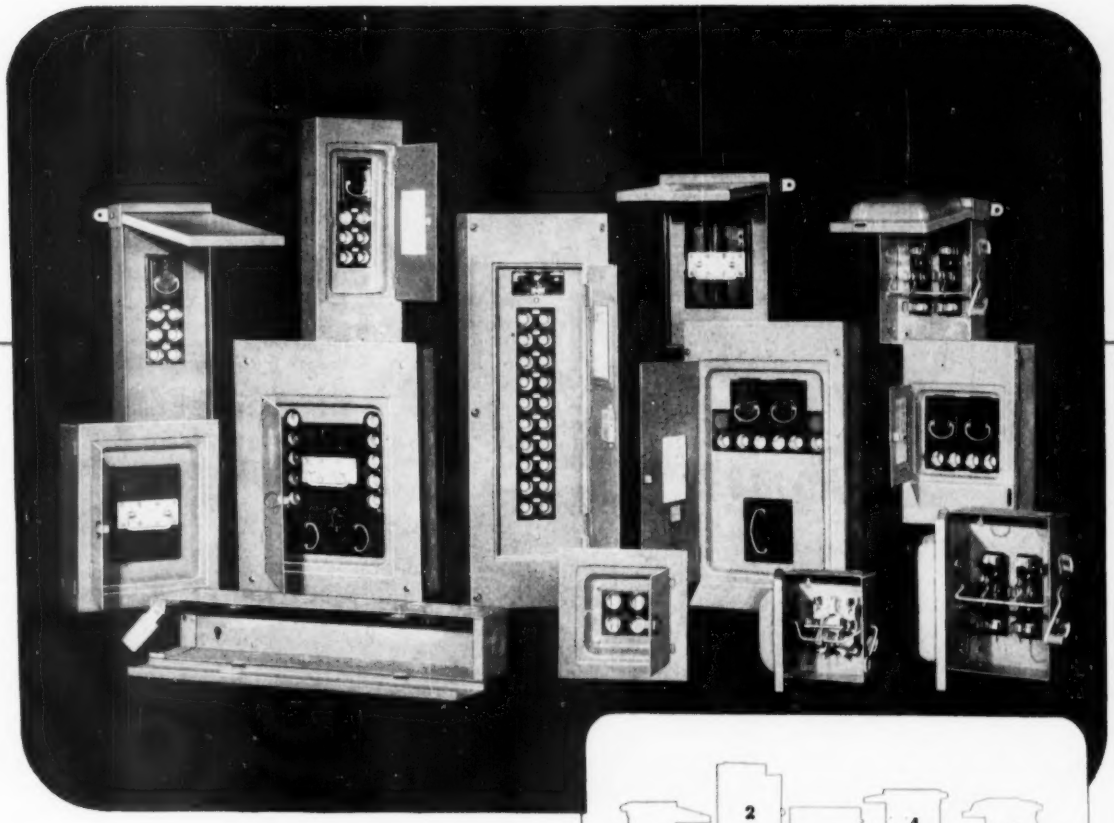
INTERIOR OF OVEN showing two of the three natural gas burners. Natural draft system exhausts fumes. Clean-out vents are at base of rear wall.

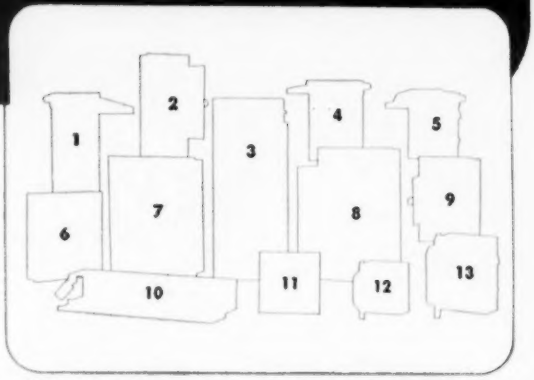
Oven walls are constructed of 8-inch concrete block on a 5-in. concrete slab base. To secure additional structural strength, the hollow spaces in the blocks are filled with steel reinforcing rod and concrete mix. A 2-inch angle-iron frame around the top of the block wall keeps edges from chipping, acts as base for hinged "lid" when closed.

To make it easier to open the oven, the "lid" was designed in two sections—each covering one half of the enclosure. Lid construction consists of two steel plates welded to a 2-in. by ½-in. flat steel frame with rock wool insulation sandwiched between.

Three natural gas burners, one for each stator, provide the incinerating flame. Each burner is 8½ inches tall and consists of a capped section of 1½-inch diameter pipe with a series of small radial holes. Stators rest on steel channels; lie on their side encircling the burner. A natural draft system exhausts smoke and fumes. Two 18-inch clean-out vents are at base of rear wall.

Quit shopping! There's a Federal Noark® fusible device for every job





YOU'LL SAVE YOURSELF time, trouble and dollars by standardizing on *one* really modern line of fusible devices... and you'll do it best by adopting Federal Noark's complete line of service entrance equipment!

There's a Federal Noark fusible device for every ordinary and special requirement. All devices have ample wiring space for top ease in wire pulling... and all are exceptionally smart in appearance; finished with gray baked-on enamel.

Order Federal Noark fusible service entrance equipment from your wholesaler and start reaping the benefits of concentrating on a single line. Federal Electric Products Company, 50 Paris St., Newark 5, N. J.

1 R166—Main Service and Lighting Panel. 60 amp. pullout head switch, up to 8 lighting circuits — raintight enclosure.

2 166—Same as R166—in general purpose enclosure.

3 NR 320L—NR Type Residence Panel, plug fuse branches.

4 R110—Main Service Panel. 100 amp. Raintight enclosure.

5 R3622—Type D Safety Switch. 60 amp., cartridge fuse, 3 wire SN, in raintight enclosure.

6 110—Same as R110, in general purpose enclosure.

7 12610F—100 Amp. Main-and-Range Pull Switch. 10 or 16 lighting circuits.

8 266W—Same as 264, plus off-peak hot water heater circuit.

9 264—60 Amp. Main-and-Range Pullout Switch. 3 pole SN. For range, hot water and lighting.

10 "AT" Wiring Troughs... complete with coupling straps and and end closures.

11 4F — Junior Type Panelboard.

12 L303328N — Type D Safety Switch. 30 amp. plug fuse. General purpose enclosure.

13 3622—Same as R3622, in general purpose enclosure.

Federal Noark products: Stab-lok Circuit Breakers, Motor Controls, Safety Switches, Service Equipment, Industrial Circuit Breakers, Panelboards, Switchboards, Control Centers, Bus Duct ★ Sales offices in principal cities.

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FOR DOLLAR VALUE

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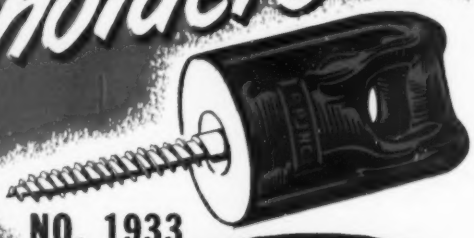
PORCELAIN PRODUCTS'

All-Porcelain Wireholders



NO. 1933
LIGHT DUTY

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MEDIUM DUTY

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HEAVY DUTY

Here's your best value for service entrance work. These all-porcelain wireholders have no exposed metal parts to rust. They're designed to stand up under far greater wind, weather and cable loads than will ever be required under excessive conditions of ice and storm. And they're economy-plus, both on initial cost and long life. Insist on PP better quality insulators . . . stocked by leading distributors.

Porcelain Products, Inc.
FINDLAY, OHIO

ANGLE IRON FRAME holds tanks, gages, regulating valves, hoses and gun required for metalizing worn parts in the shop of Braunlich-Roessle, Pittsburgh, Pa.

Metalizing Equipment On Special Rack

A compact rack and a handy gun-type portable tool provide the requisites for metalizing worn shafts in the shop of Braunlich-Roessle, Pittsburgh, Pa. The rack, shop assembled from angle iron, steel straps, plywood and chain, holds tanks containing acetylene, oxygen, etc., and all necessary regulating and measuring devices. The spray gun, a product of the Metalizing Engineering Company, converts metal rod into a metal spray which may be directed to the worn section being rebuilt.

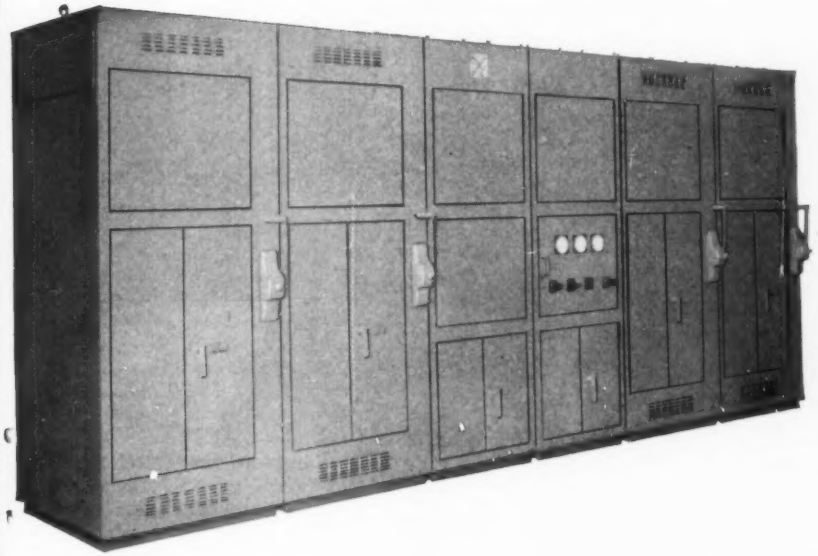
Although the rack is generally left in one spot, it may be lifted and shifted by means of an industrial fork truck or a cradle suspended from an overhead monorail hoist. Therefore, when it is impractical to bring work to the spray area, it is possible to take the spray equipment to the work. This assembly is both handy and compact and is in frequent use.

TAKING A BREATHER between classes during the Winona session of the Minnesota Electrical Association's traveling estimating school are contractor Hugo Mueller of Cannon Falls, Minn., and William Patenaude, Lehn Electric, Anoka

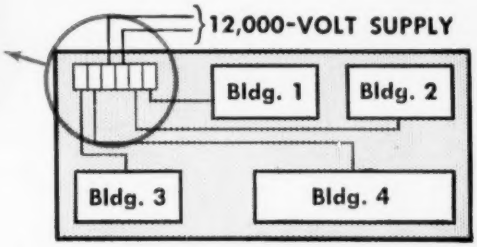
METALCLAD SWITCHGEAR PROVIDES

Low Cost Switching Centers

S&C has demonstrated time after time that expensive circuit breakers are usually unnecessary in switching centers. S&C Switchgear serves every needed purpose in high voltage industrial power distribution, at a cost usually about half that of circuit breakers.



In an aircraft plant, for instance, selection of S&C Metalclad Switchgear substantially reduced cost of the switching center. This 6-bay unit provides two separate metered sources of power, and protection for the outgoing feeders to the load centers in each of the buildings.



S&C BRINGS A NEW CONCEPT OF PROTECTION AND SERVICE

S&C equipment has been recognized by public utility engineers as "tops" for over 40 years. WHY? Because it permits greater flexibility in substation layouts—greater dependability in performance—greater convenience and safety of operation.

A new booklet on Metalclad Switchgear explains the fundamental concepts of S&C engineering, and how they affect the economics of industrial power distribution. Would you like a copy? Send the coupon.

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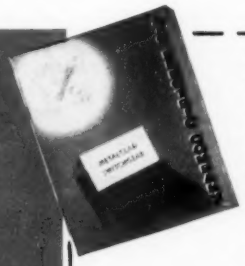
SPECIALISTS IN HIGH-VOLTAGE CIRCUIT INTERRUPTION



S&C Electric Company
4433 Ravenswood Ave., Chicago 40, Illinois

Please send me your new booklet on S&C Metalclad Switchgear. No obligation on my part, of course.

Name _____ Title _____

Company _____

Address _____

City _____ Zone _____ State _____

NEW BENJAMIN "PANEL-GLO"
cuts former Benjamin Price for ceiling louvers by as much as 50%!

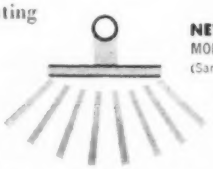
NEW BENJAMIN "SKY-GLO"
Louvers now priced approximately 33⅓% less!

2 Great Advancements Insure Quality Lighting to Benjamin's High Standards at New Lower Prices!

New low prices and all-around simplification of Benjamin luminous ceiling lighting enable you to increase your ceiling lighting prospects by offering a lower installed price. Benjamin "Sky-Glo" and "Panel-Glo" represent a brand-new approach to ceiling lighting for stores, offices, etc. Here is lighting that is engineered for simple, low-cost installation . . . designed for high-level, well-diffused lighting quality, featuring the maximum seeing comfort always associated with Benjamin *translucent* ceiling lighting.
Send for Free "Sky-Glo" and "Panel-Glo" Data Bulletin. Benjamin Electric Mfg. Co., Dept. H, Des Plaines, Illinois.

NEW Simplicity brings down installed price!
New, practical, easy-to-handle 3′ x 3′ translucent panels or louver sections.

NEW, Easier installation brings down installed price!
No need to order "fill-in" size panels. Trim them yourself with scissors . . . right on the job . . . to the exact shape desired!
New metal FINISHING STRIPS neatly hide trimmed edges on either louver or luminous-panel jobs.



NEW, proven TRANSLUCENT plastic material means MORE LIGHT with CONTROLLED BRIGHTNESS.
(Same material used for "Sky-Glo" and "Panel-Glo.")

NOW, figure the complete price of a ceiling-lighting job by the sq. ft.!
Sq. ft. price includes all panels or louver sections as well as all the channels, fittings, etc. you need to complete the installation!*
No calculating, no figuring . . . just know the area of the room!
No layouts necessary for regularly-shaped rooms.
*lighting equipment not included.

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Lighting Equipment
sold exclusively through electrical distributors

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Modern Lighting

Modern Merchandising Calls for Lighting Variety

The high-key atmosphere in Lane's Department Store, New York City, is obtained by the judicious combination of pastel colors and a lighting system having pleasing variety. This variety is first observed by shoppers entering the first-floor sales area, for light sources include both incandescent and fluorescent lamps, and shielding is furthered by cover, louvers, valances and recessed housings.

General illumination in this main-floor area averages 30-footcandles, supplied primarily by circular ceiling units recessed at 10-foot centers in both directions. These fixtures (Ruby-Phylite N815s) are equipped with a central 300-watt filament lamp and eight 15-watt fluorescents around it. Circular louvers are white-enamel.

Illumination is built upon service counters along the various walls by recessed louvered downlights placed on 5-foot centers and lamped with 150-watt R-40 floods.

Additional light for the display of merchandise on wall racks and shelves is furnished by two continuous rows of 40-watt T-12 warm white fluorescents, one row mounted just above the merchandise behind an 8-inch cove, and the other row combined in a perforated wood valance. In addition to adding illumination to the display areas, this valance lighting also illuminates the wall-mounted carved-letter signs above the counters and wall cases. Depending upon the proximity and arrangement of merchandise, these continuous strip lights deliver from 110-footcandles (on the shoulders of blouses) to 20-fc (lowest shelves, vertical plane).

On the first floor, ceilings are white, walls light green and floors grey terrazzo. Valances are painted white on the inside, yellow green on the outside; while sign lettering above valances is burgundy red.

In areas removed from the walls, glass-topped display cases are lighted by conventional case reflectors, while signs, visible from two sides, are made up with translucent lettering and low-wattage incandescents mounted within the sign enclosures. The underside of the escalator is distinguished by a 4-lamp eggcrate-louvered strip that provides an abundance of illumination on moving stair treads.

On upper floors in the building, central areas are lighted generally by recessed tungsten and fluorescent lamps louvered to an average level of 35-fc, while counters along the walls have 48-fc readings, with light coming from recessed Ruby-Phylite 3-lamp eggcrate troffers equipped with deluxe warm white lamps. The aisle behind the counters is illuminated by circular 200-watt filament recessed units having ribbed-glass cover plates, while wall cases are top-lighted by coved fluorescents and additionally illuminated by a valance containing a single row of T-12 warm white 40-watt lamps mounted end to end. Footcandle values

FIRST FLOOR SALES AREA has general illumination averaging 30-footcandles, obtained by circular louvered recessed incandescent-fluorescent ceiling fixtures mounted on 10-foot centers in the white acoustical ceiling.

LOUVERED 3-LAMP TROFFERS above display cases provide 48-footcandles to counter tops. Recessed circular ribbed-glass incandescent units light aisle behind merchandising sales sections, while single row of warm white fluorescent lamps behind the valance and top lights incorporated in each wall case provide attractive high-lighting.

inside the glass-door cases range from 40 to 25.

Of particular interest is the mirror lighting in the millinery department where women can study the effect of a hat under 30-footcandles of illumination, provided by warm white fluorescents and 200-watt filament units. The mirrors are suspended in 6½-inch deep niches having a vertical-plane distance of 5½-inches between the mirror and the side walls and between the mirror and the bottom shelf. Just back of the mirror edge, along the bottom and both sides, are six 15-watt T-12 deluxe warm white tubes and, also contributing to this pleasing color tone, the surface of the niche in which each mirror is mounted is painted shell pink. The shelf before each mirror is light tan, as is the floor, with panels between mirrors of deep rose. Wall surfaces above mirrors are light blue.

DETAIL OF VALANCE LIGHTING above wall cases is indicated by this picture revealing one continuous row of fluorescent lamps shielded by a perforated wooden valance; a second row shielded by the upper lip of the cases. Ceiling fixtures in the central area were turned out to emphasize the valance details.

MILLINERY MIRRORS are set in niches painted shell pink. Illumination in order of 30-footcandles is provided by 15-watt T-12 deluxe warm white lamps mounted behind the mirror along both sides and the bottom. Overhead unit in general ceiling is circular incandescent ribbed glass recessed fixture.

Bank Utilizes Dual Lighting

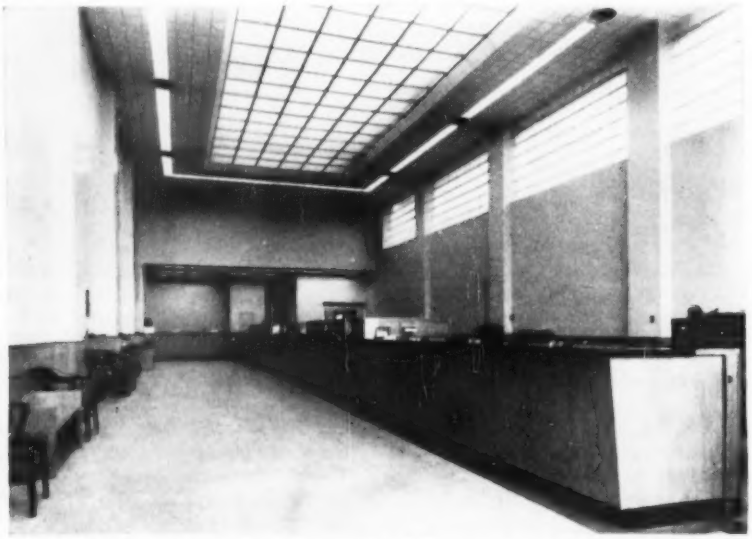
The Bank of Montreal in New Westminster, British Columbia (Canada) uses dual lighting to illuminate its main banking hall. A louvered skylight and a system of recessed troffers provide artificial lighting, which supplements natural lighting through glass blocks installed high in the wall behind the banking counter.

The artificial lighting from the ceiling is entirely fluorescent. Covering approximately one half of the ceiling is a deep louvered section, above which are installed industrial type fluorescent luminaires in groups of two, each using two 40-watt fluorescent lamps. These reflector luminaires are wired on alternate circuits, and provide varying degrees of illumination by means of switch control.

Surrounding the louvered skylight section is a continuous row of recessed troffers using eggcrate shielding, broken at regular intervals by flush air conditioning outlets. Additional rows of these same type troffers also traverse the width of the room at the front, since the louvered skylight is located towards the rear of the room. These troffers also use two 40-watt fluorescent lamps per four foot section, and are controlled separately from the louver skylight, providing still further flexibility in illumination intensity by switch control.

Provision has been made for servicing the reflectors above the louvered section from above the ceiling. Ladders are used to service the recessed troffers from the floor. The ceiling is approximately 20 feet high.

Architects for this bank were Sharp & Thompson, Berwick, Pratt. A. Edward Simpson was the consulting engineer, and the J. H. McRae Company, Ltd., were the electrical contractors. All are located in Vancouver, B. C., Canada.



ARTIFICIAL LIGHTING from a louvered skylight and recessed fluorescent troffers supplement natural daylighting through a glass block wall in the Bank of Montreal, New Westminster, B. C., Canada.

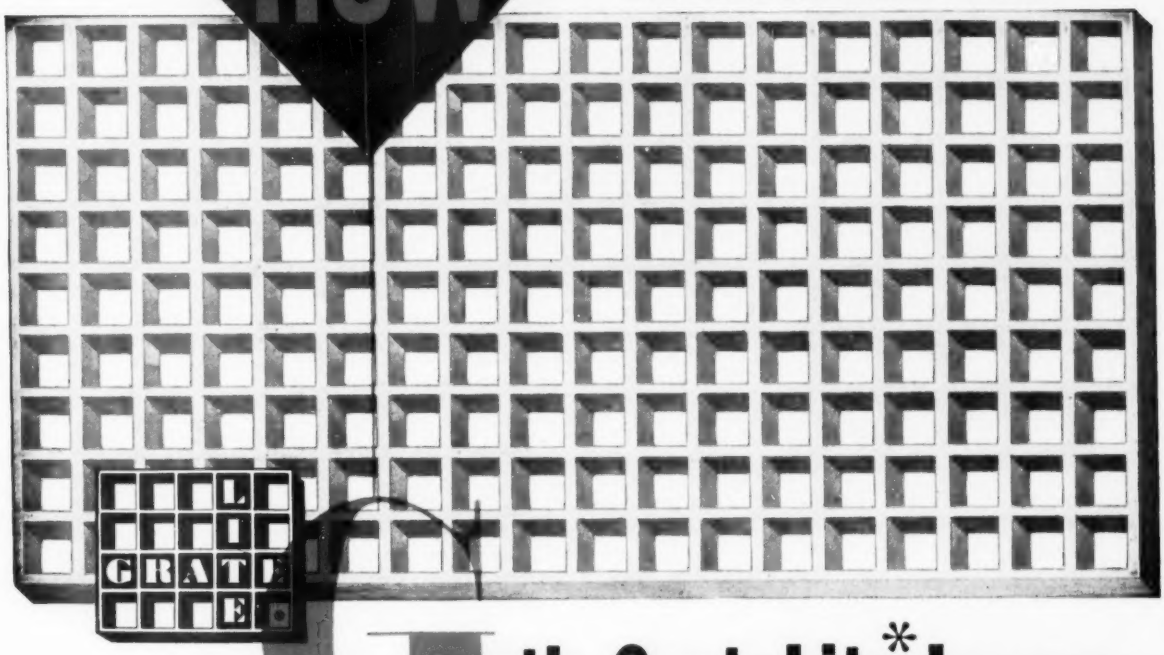
Airport Taxiway Directional Signs Aid Pilots

Here is a brand new item for potential business for contractors in the airport lighting field—the illuminated airport taxiway directional sign. These signs will be of great assistance to pilots (both day and night) in finding their way around the large terminal-type airports—especially where there are dual runways and numerous taxiways. At such fields, more than 100 signs may be required for runway turnoffs and destination markers. These lighted signs will also assist control tower personnel, since pilots will not require so many radio instructions from the tower.

The signs are from about 2 to 6 ft long (depending on the number of characters) and 14 in. high and are made of sheet steel or aluminum

new

OPEN LIKE A LATTICE
DIFFUSING LIKE GLASS



Guth GrateLite* Louver

the latest idea in lighting

A SYMPHONY OF DIFFUSED LIGHT

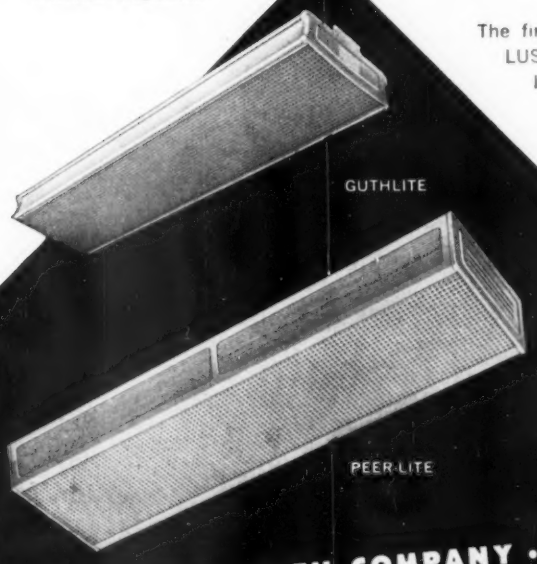
* U.S. & Can. Pats. Pend.
Trademark Registered

The first integral plastic louver for fluorescent lighting, molded of LUSTREX polystyrene. It reveals a new conception of architectural beauty and efficient lighting: Its diffusion results from the ⅜" cubical lattice that cuts off direct light at a 45° angle.

But words alone cannot describe beauty. See for yourself and ask to be shown a sample. It will give you a new outlook on lighting.

GrateLite is tough, quickly cleaned and de-staticized. It is furnished in one piece with Guth Fluorescent Fixtures.

Write today on your letterhead for complete information.



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Prescolite manufactures a complete line of Swivel Lites, Architectural and Recessed fixtures for any installation.
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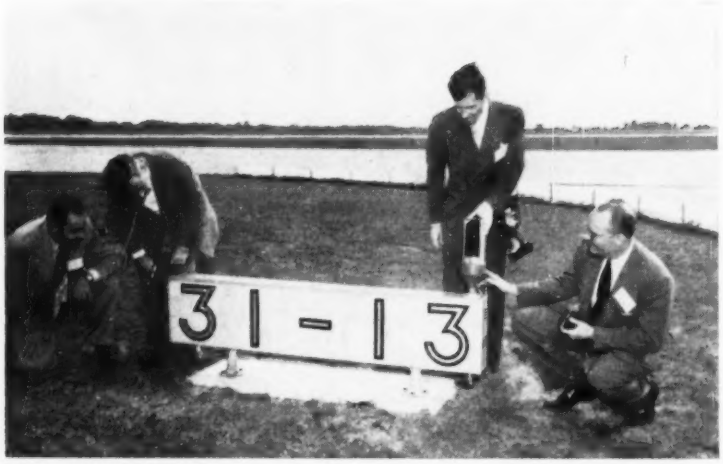


NEW TAXIWAY SIGNS help pilots find their way around large terminal airports and reduce tower radio instructions required. Picture shows members of the IES Committee on Aviation Lighting inspecting signs being tested by the CAA at Indianapolis Municipal Airport.

painted yellow for maximum daytime visibility. They are mounted on concrete bases with pipe supports having breakable couplings in case they are struck by a plane. The numerals and letters have yellow plastic in back of the cut-outs outlined with a ¾ in. black stroke. Each letter or numeral has two 325 lumen (about 29 w) 6.6 amp lamps or a maximum of about 300 w per sign. Signs at runway intersections are connected to the adjacent taxiway lighting circuits (which may be either series or multiple) through isolating transformers. Those on taxiways are, of course, connected on the taxiway circuit.

The approximate cost of the signs varies between $100 and $300, depending on size.

Panels of Light in Drafting Room

Panels of light, set flush in an acoustical ceiling, now provide 100 foot-candles of comfortable lighting in the engineering department of the new office building of the Van Huffel Corp., Warren, Ohio. The minimum shadows and glare in the interior and the low surface brightness of the panels are particularly well suited to the drafting and designing operations.

The installation consists of twelve 6-ft. by 12-ft. panels of Smithcraft Area Illumination. Fluorescent lamps are mounted on 12-in. centers above

LIGHTING PANELS, integrated with metal acoustical pans and anemostats in a finished ceiling system, afford high level, comfortable illumination in this engineering drafting room.

Create the Mood with

LITECONTROL

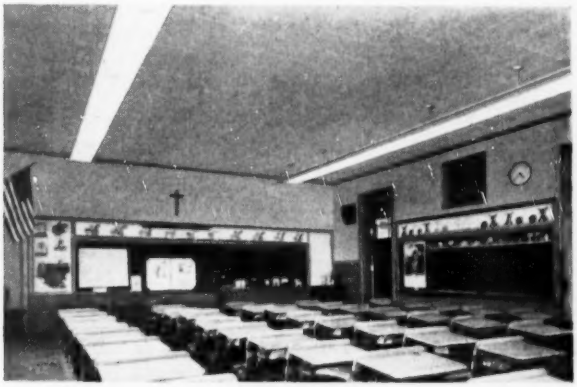
For Selling, Litecontrol Fixture No. 5928 puts products in their *best* light. Holophane low-brightness lens furnishes even illumination. Removes all glare and sharp contrasts. Simple, smart and efficient. Also available with diffusing glass panels.

For Displaying masterworks in this Art Museum, Litecontrol paints the scene with F-74 4-lamp fixtures. "Custom" in appearance and performance only, modified "standard" design makes them exceptionally economical.

For Working, Litecontrol keeps busy eyes sharp in this office with No. 5124 and No. 5128 2-lamp fixtures. Smart and unusually efficient. Holophane CONTROLENS prevents glare and sharp contrasts. Hinged door frames open or close *at the snap of your fingers* — on exclusive Litecontrol *Trigger Catch* snap-locks.

•

There's a LITECONTROL Fixture for every scene and situation. You, too, can have "custom" beauty and performance at "standard" prices. Write for catalog and complete information.



For Learning, Litecontrol Fixture No. 4624 helps pupils see through the tough ones. Good looking, eighty-six per cent efficient, its low initial cost and simple maintenance make it popular for classrooms.

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The McKinley 2 & 4 Lamp

4 & 8 FT. LUMINOUS INDIRECT LUMINAIRES—

- Modern designer styling, creative engineering and fine craftsmanship are combined into a unit of exceptional beauty and high overall efficiencies.
- Curved panels of white, ribbed polystyrene give high reflectivity and produce a luxurious quality of illumination.
- The illuminated unit blends into the ceiling since its surface brightness and that of the ceiling are nearly equal.
- Unit is below the minimum brightness specifications of Illuminating Engineering Society.

Write for Data Sheet B-9 for Complete Specifications

PITTSBURGH REFLECTOR COMPANY

404 OLIVER BUILDING, PITTSBURGH 22, PA.

FLUORESCENT "Pittsburgh" Permaflector *INCANDESCENT*

Lighting

REPRESENTATIVES IN PRINCIPAL CITIES • WHOLESALERS EVERYWHERE

PITTSBURGH REFLECTOR COMPANY

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Yes—I want to know more about the new silver-mirrored square downlights. Send Specification Sheet.

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Company _____

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the panels. White metal eggcrate louvers, in 3-ft. by 2-ft. sections, provide shielding of 45° crosswise and 45° lengthwise. The room itself is 35-ft. by 43-ft. 8-in., with finished ceiling height of 9-ft.

Between the lighting panels, snap-in acoustical metal pans are supported by the framework for the lighting installation, thereby eliminating the ordinary multiplicity of supports which would clutter the plenum and increase the cost of the installation. The pans snap directly into the main runners of the panel system.

This integrated lighting-ceiling system, which allows for the installation of anemostats in optimum positions, is a product of Smithcraft Lighting, Chelsea, Mass.

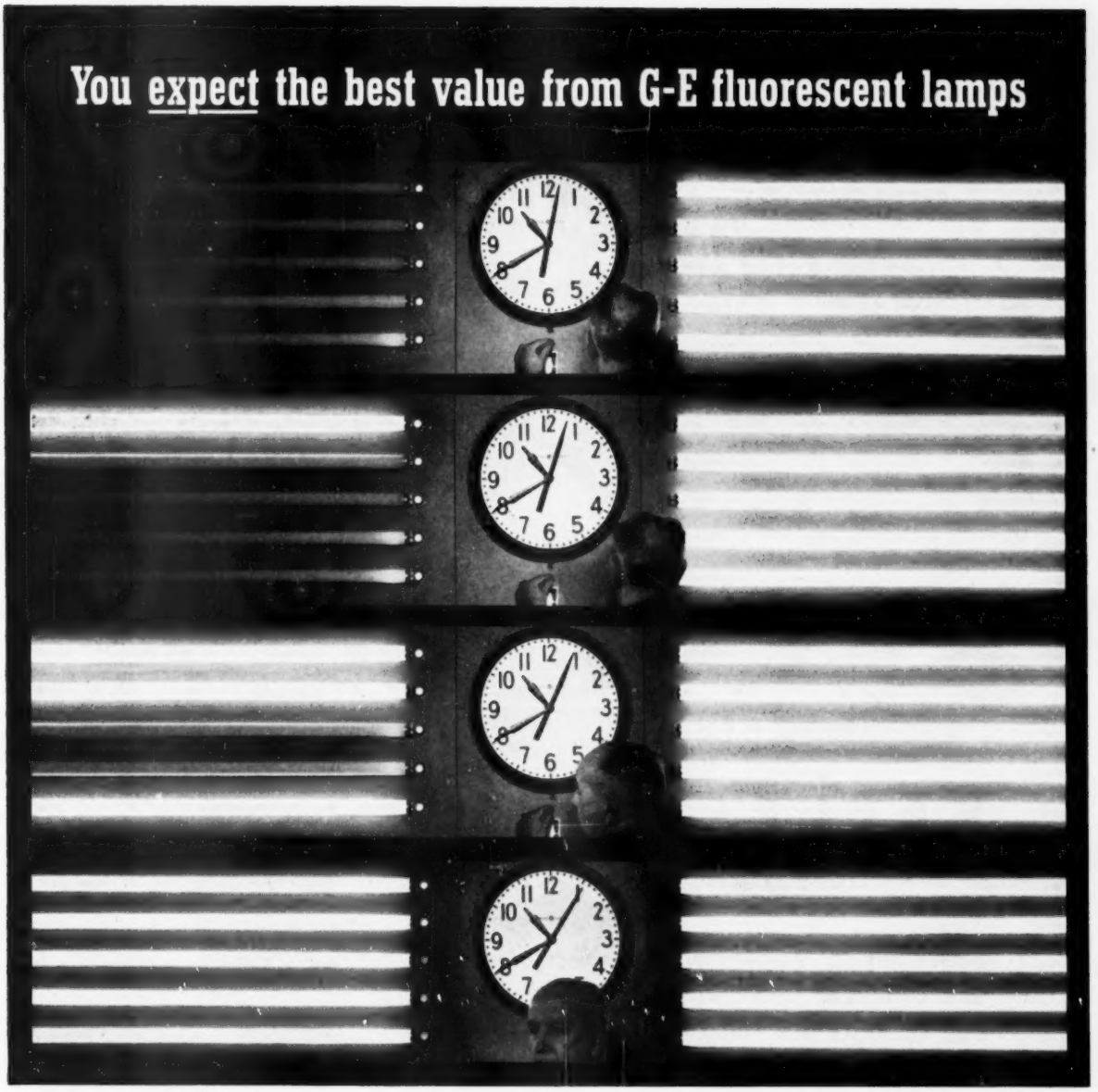
Combination Lighting Sparks Gift Shop Sales

A combination of fluorescent and incandescent overhead lighting provides evenly distributed general illumination of excellent color quality for the main selling areas of the Mark Cross store on Fifth Avenue, New York City and accent lighting to create sales appeal for special displays. Continuous rows of type CL-240 Sylvania louvered fluorescent luminaires with companion type CP-150 incandescent floodlights installed between the 4-foot fluorescent sections, are used throughout the 32-ft. by 66-foot area of the main floor, and the basement selling area.

The fluorescent luminaires each contain two 40-watt soft white lamps which have been found to be flattering to leather goods and other similar

FLUORESCENT AND INCANDESCENT lighting are combined to provide good color quality for the leather goods and gift displays in the Mark Cross Fifth Avenue Store, New York City.

You expect the best value from G-E fluorescent lamps



New G-E fluorescent lamp starts quicker, needs no starter

Watch the clock. Above are four unretouched photos taken about one second apart. On the left are regular fluorescent lamps, on the right the new General Electric *Rapid Start* fluorescent lamps. All were started at the same instant.

Within two seconds, all five G-E *Rapid Start* lamps are fully lighted. The regular lamps are only beginning to light.

Two new General Electric developments made the *Rapid Start* lamp possible: a triple coil cathode that holds more starting chemical and a *Rapid Start* ballast that pre-heats the lamp automatically. No starter needed. No wait for pre-heating. Starting is almost instantaneous, maintenance is simpler, cheaper.

Rapid Start lamps and ballasts are now available. You *expect* the best value from G-E fluorescent lamps. Here's one more reason why you can.

For free folder, "Facts About Rapid Start" write General Electric, Dept. 166-EC-6, Nela Park, Cleveland 12, Ohio.

You can put your confidence in —

GENERAL ELECTRIC

THE GREAT OUTDOORS
HAS A BIG SALES ANGLE
ANGLE REFLECTORS FOR SIGNS
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REFLECTORS

for a variety of installations

You'll find the correct unit for most outdoor lighting requirements in this modern and complete line. You'll also find that these units are flexible in design, fully weatherproof, and that the porcelain finish is permanent.

Ease of installation and dependability of performance are among the reasons QUAD REFLECTORS are specified by so many contractors.

Put your outdoor lighting problems up to QUADRANGLE and get the answers that mean sales and profit for you.

Sold through Electrical Wholesalers

QUADRANGLE MFG. CO.

32 S. PEORIA ST. CHICAGO 7, ILL.

merchandise displayed in this store. Showcases and the recessed troffers above them also contain soft white color fluorescent lamps. The incandescent floodlight units, focused along the counters and working lines of the store, are equipped with PAR-38 150-watt incandescent lamps. The color of these lamps blends well with the color of the fluorescent lamps to make an efficient yet unobtrusive lighting system. The floodlights can be adjusted as desired to emphasize special displays.

Luminaires in the main selling area are mounted at a height of 14 feet from the floor, and provide approximately 25 footcandles of illumination from the fluorescent lighting only. With the floodlights turned on the average intensity is approximately 45 footcandles, but provides intensities ranging up to 75 footcandles on the special displays.

Amend and Gertz of New York City were the electrical contractors for this installation.

TAX CONSULTANT E. E. Ranta, Minneapolis attorney, gives Minnesota electrical contractors a few pointers on business tax problems and how to solve them.

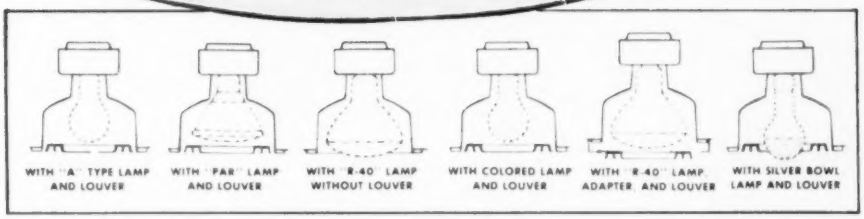
EARLY ARRIVAL at annual meeting of Midwest Electrical Council in Minneapolis gives contractors W. J. Tellers (left), Chaska, Minn., and Everett Taylor, Wayzata, Minn., chance to talk shop before session begins.

DAY-BRITE
DERBY DOWNLIGHTS

No. 80141—with 6¾" diameter Controlens* in removable frame. Recommended for use with 100-watt Type "A" lamp.

*®HOLOPHANE CO.

No. R-80140—with removable matt black steel louver. For PAR-38 or Type "A" lamp to 150-watt size. Without louver for R-40 lamp, 150 to 300-watt.


WITH "A" TYPE LAMP AND LOUVER
WITH "PAR" LAMP AND LOUVER
WITH "R-40" LAMP WITHOUT LOUVER
WITH COLORED LAMP AND LOUVER
WITH "R-40" LAMP ADAPTER AND LOUVER
WITH SILVER BOWL LAMP AND LOUVER

FOR

Window Display
Marquees
Stores
Lobbies
Soda Fountains
Reception Rooms
Murals
Bathroom Heat Lamp
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Day-Brite Derby units are low-cost, highest quality incandescent downlights. These versatile, easy-to-install recessed spots can take a lighting installation out of the ordinary class—give it sparkle and glamor—without excessive expense. And all Derby Downlights are approved by the Underwriters' Laboratories.

Ask your Day-Brite representative for full information.

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DAY-BRITE
Lighting Fixtures

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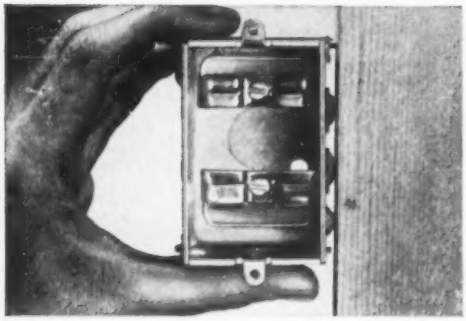
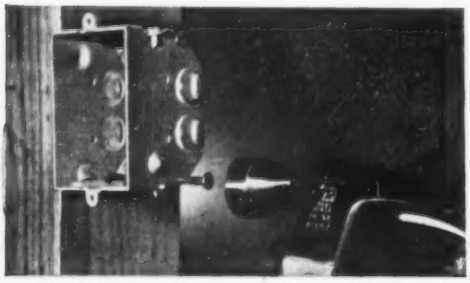
IN CANADA: AMALGAMATED ELECTRIC CORP., LTD. TORONTO 6, ONTARIO

340

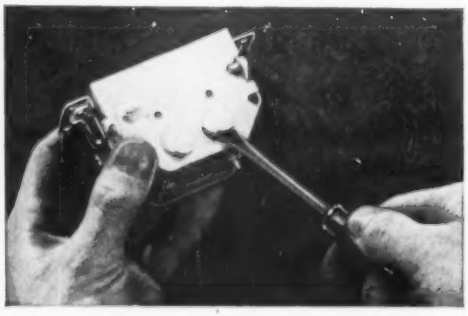
How G-E Levelock boxes cut roughing-in time 5 ways



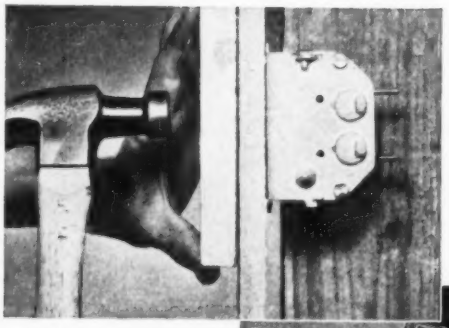
1. Four leveling projections — instead of the usual three, keep G-E Levelock boxes straight and level when mounted against studding. Wall plates go on with even, uniform neatness.



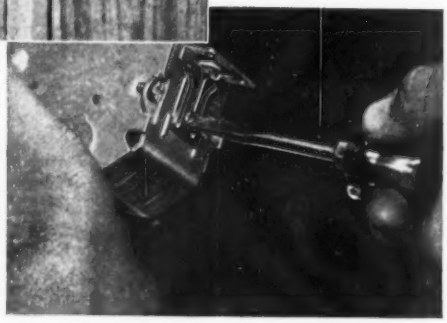
2. Special nail through holes—for real mounting speed without taking the box apart. The nail through holes are in addition to the conventional side-plate nail holes.



3. Side pryouts—solve unusual installation problems. Easily and quickly removed by a simple twist of a screwdriver blade.



4. Exclusive locking design — keeps side plates tightly wedged in position. G-E Levelock boxes won't fall apart when carpenters scribe cutouts — no time wasted in fishing for boxes lost in partitions.



5. Single-screw ears and 1/8-inch guide marks — permit quick adjustment to any wall thickness. Ribbed design and the bridge across the ear give increased strength.

G-E Construction Materials Distributors offer 21 G-E Levelock Sectional Device Boxes.

Use the time-saving features of General Electric Levelock device boxes on your next wiring job. You'll find 21 Levelock boxes to choose from at your G-E Construction Materials distributor. All Levelock boxes are designed to speed wiring. Section C20-618, Construction Materials Division, General Electric Company, Bridgeport 2, Connecticut.

You can put your confidence in—

1878 75 1953 YEARS OF ELECTRICAL PROGRESS

GENERAL ELECTRIC

In The News

IES Conferences Held

Three meetings held in May wound up the regional conference program of the Illuminating Engineering Society for the 1952-53 fiscal year. These conferences were: East Central—Baltimore, Md., May 14-15; Southern—Greensboro, N. C., May 18-19; and Great Lakes—Syracuse, N. Y., May 25-26. All three conferences featured outstanding technical sessions, with papers and talks devoted to lighting subjects of paramount interest to members of the lighting industry in these regional areas.

Attendance at the East Central Regional conference was over 100 members, with an additional 75 guests. A highlight of this meeting was a forum on Visibility, in which three speakers covered various aspects of the problem of seeing. Dr. Israel Dvorine, Baltimore, discussed "Optical Aids for Better Seeing." James M. Ketch, General Electric Co., Nela Park, Cleveland, discussed "Visibility of Task," and Willard Allphin, Sylvania Electric Products Inc., Salem, Mass., discussed "Studies in Physiological Cost of Seeing." Paul H. Hildebrand, East Central Regional Vice President, led the Forum discussion.

Other talks and papers included an address by Prof. E. M. Strong, IES President; a paper on "What Has Happened to Lamps and Ballasts?", by R. F. Townsend, Westinghouse Lamp Division, Bloomfield, N. J.; "Relationship of Brightness and Illumination Levels for Luminous Ceilings" by Robert D. Burnham, Wakefield Brass Co., Vermilion, Ohio; and "Acoustics and Lighting" by Eric H. Church, Benjamin Electric Mfg. Co., Des Plaines, Ill.

President Strong reported on IES growth, both in members and in the art and practice of illuminating engineering. Using the Society's initials, IES, he related these to "Inspiration," "Education" and "Service," and pointed out that future growth of the Society is greatly dependent upon these three factors.

One session was devoted to the "My Most Interesting Lighting Job" contest, in which five contestants, one from each Section comprising the East Central Region, participated. Winner in this contest was L. E. Spears, Pennsylvania Power Co., Pittsburgh, representing the Pittsburgh Section, IES. His lighting installation was a Pennsylvania jewelry store, and winning of the Regional Award automatically qualifies him to enter the final run-off at the 1953 National Technical Conference in New York in September.

The Southern Regional Conference was attended by more than 125 members and guests, representing the lighting industry in the Carolinas, Tennessee, Mississippi, Alabama, Louisiana, Georgia and Florida. The program consisted of four sessions, covering a broad range of timely lighting topics.

Prof. E. M. Strong delivered his Presidential address following a welcome to Greensboro by Hon. Robt H. Frazier, Mayor of Greensboro. President Strong stressed the need for better street and highway lighting, and urged greater activity in home lighting.

Two papers were devoted to residential lighting. "Progress in Home Lighting" was reported on by E. W. Commery, General Electric Lamp Division, Nela Park. Mrs. Charlotte Creighton, Duke Power Co., Charlotte, N. C. talked on "Meeting the Need for Home Lighting Information", and demonstrated equipment which she uses in talking to homeowners.

T. C. Sargent, Sylvania Electric Products Inc., Salem, Mass. gave a "Salute to Lighting Progress", demonstrating many new developments in lamps and lighting by actual samples, and showing other developments in electrical application techniques by lantern slide.

One session was devoted to color. A paper on "Color and Illumination for Room Interiors" was given by J. A. Meacham, Sherwin-Williams Co., Cleveland, using a series of color charts for illustration and demonstration. "Color in Lighting" was the subject of an illustrated talk given by M. L. Harkey, General Electric Lamp Division, Charlotte, N. C., in which the new color reflector lamps were demonstrated.

"Lighting of the Greater Pittsburgh Airport" was the subject of a paper prepared by James Paul Warner, Electrical Engineer, Pittsburgh, and read by Wilson Marshall, Garcy Co., Charlotte, N. C. for Mr. Warner. This paper was illustrated by a series of excellent colored slides. R. D. Burnham, Wakefield Brass Co., Vermilion, Ohio discussed "Brightness vs. Illumination for Luminous Ceilings", and R. L. Zahour, Westinghouse Electric Lamp Division, Bloomfield, N. J. discussed "Economics in Classroom Lighting".

Winner in the "My Most Interesting Lighting Job" contest for the Southern Region was Mario G. Zervigon, L. N. Goodman Consulting Engineers, New Orleans, La., whose lighting job was a floodlighting installation on a building exterior.

The Great Lakes Regional Conference was held in Syracuse, N. Y., and was in progress as this report was being written, hence no details are available.

NISA

As we go to press, NISA's twentieth annual meeting is starting at the Hotel Statler in New York. While our staff will be actively covering the sessions and the trade show, our story must wait until our next issue. Watch for the Convention Report on this page next month.

Western Chapters of IAEI Hold Meetings

Charles L. Smith, secretary-treasurer, International Association of Electrical Inspectors, recently attended a series of meetings held by the Western Chapters. With a preprint copy of the final changes for the 1953 edition of the National Electrical Code in hand, Smith was able to clarify many of these by reading new wording suggested. Toward further understanding, he announced that Frank Thornton, recently retired Westinghouse codes and standards member of the electrical coordinating committee, had been given the task of rewriting the wording of the NEC and of removing its existing discrepancies between various included articles.

Mr. Smith began his series of meetings with an informal luncheon at Phoenix with the members of the Arizona Chapter, April 4, presided over by M. V. Williams, chapter chairman. Successive meetings were held at San Diego April 8 with the Southern California Chapter, Barney Alverson, San Bernardino County inspector, chairman; Stockton April 11, a joint meeting of the Sacramento Valley, the Northern California and

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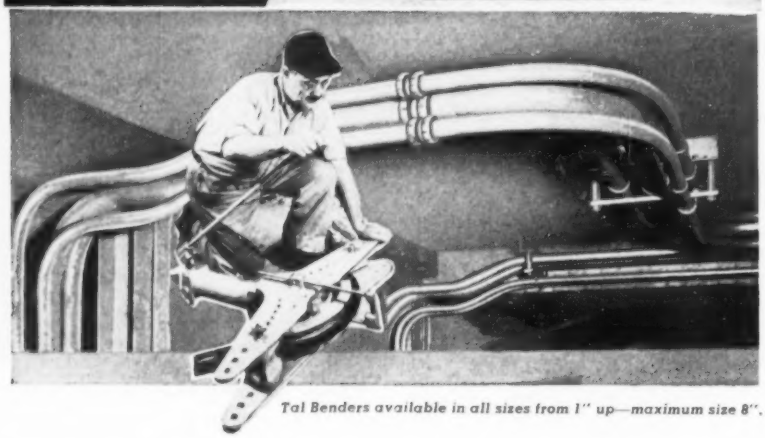
BEND THINWALL or RIGID CONDUIT FASTER



Tal Benders available in all sizes from 1" up—maximum size 8".

You can earn bigger profits by reducing up to 80% the number of elbows and couplings otherwise needed. Save on cutting, threading and installing. This is possible with a Tal, because Tal Portable Benders make any degree bend in one *setting without shifting the conduit* . . . and do the job faster!

No guesswork for offsets, long sweeps or any other bends. No experience necessary to make accurate, wrinkle-free bends quickly, right on the job.

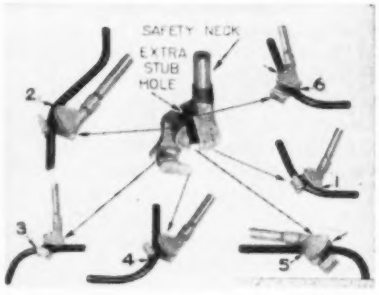
No spoilage. Bend indicator assures identical repeat bends without measuring.

Actual bending time of a 90° bend in 3" conduit with a motorized Tal Bender—1 minute, 51 seconds. Other sizes in proportion. Assembly time of a Tal Bender (2 parts only)—less than 1 minute.

Learn today how you can earn more money and handle more jobs with a Tal Portable Bender.

TAL 6-WAY HICKEY FOR RIGID CONDUIT

Exclusive design of the six non-slip bending jaws assures perfect elbows, offsets, loops, saddles, stubs and sets in close quarters or on open slab work. No effort, no kinks. The bending jaw grooves of this "Safety-First Hickey" are slip-proof, and long safety neck prevents it from breaking at the threads. Has extra stub hole for bending conduit protruding from concrete. *Guaranteed for life against breakage.*



Nos.	Size	Weight	Package Price of Ten	Unit Price
50	½"	3½ lbs.	$3.10 ea.	$3.70 ea.
75	¾"	5 lbs.	3.90 ea.	4.65 ea.
			Package Price of Three	
100	1"	8½ lbs.	6.65 ea.	7.95 ea.

COMPLETE LINE OF BENDERS
For rigid conduit up to 5 *inch* and small Combination Production Benders for Rigid and Thinwall Conduit, for ½" and ¾".

WRITE FOR THIS FREE BULLETIN

Tal Bender, Inc. Dept. 21 Milwaukee 2, Wis.

the Central California Chapters, presided over by Clyde Narvez, Richmond, Northern California chairman, J. P. McClue, Lodi inspector, Sacramento Valley Chapter chairman, and Ray Colby, Fresno, Central California Chapter chairman.

In Nevada the chapter meeting took on the proportions of a convention at Elko, April 17, with Howard Lindsey, California-Pacific Utilities Co., Winnemucca, chapter chairman. In Salt Lake City the Utah Chapter meeting April 20, was presided over by Orion Eskelsen, Brigham. In Boise the Idaho Chapter met with Smith on April 22, Floyd Warner, The Lighthouse, Kellogg, chairman. Smith then went on to meetings of the Oregon Chapter at Portland April 24, Puget Sound Chapter at Tacoma April 25, Eastern Washington Chapter at Spokane April 27, and thence to Rocky Mountain Chapter, Denver, April 29 and Montana Chapter at Helena April 30.

At each of the meetings Smith summarized the activities of IAEI. He particularly invited all inspectors to attend the Silver Anniversary all-section convention of IAEI at Chicago September 21-26. At this convention, special problems are to be treated by national authorities, particularly mentioned were to be a discussion of X-ray installation problems, another on motor control and protection, another on furnace control installations. The chairman of all the code panels and the correlating committee on the National Electrical Code, he said, would act as moderators for sessions dealing with questions and answers on the code.

In each meeting he also presented a sound slide film prepared by the cord manufacturers' group for the public relations committee of the IAEI and made available to all of the chapters for presentation to luncheon clubs, PTAs, schools, etc.

NISA News

Mid-South Chapter's first quarterly meeting was held in Nashville, March 14, at the Andrew Jackson Hotel. Forty-one members and guests attended. Many of the members arrived the evening of March 13 and attended the local roller derby as guests of H. Ed. Grant, Tennessee Electric Motor Service, Nashville. The program the following day included talks by Lloyd Schoen on "How To Collect Past Due Accounts," and George Treiber, John C. Dolph Co., on types of baking varnish.

• • • •

British Columbia Chapter's new officers are: chairman, Kenneth J. Mc-

Simplify your grounding problems!

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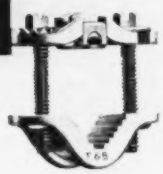
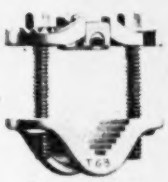
½" to 1"

1¼" to 2"



2½" to 3½"



4" to 5"

6"

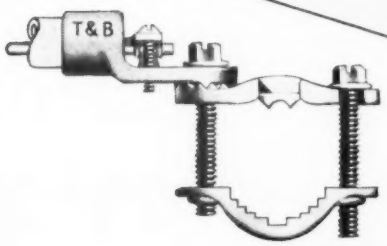
Each Water Pipe Clamp is a complete ground fitting for bare wire.

and 5 T & B Hubs

Hubs for ½", ¾", and 1" conduit

Adjustable length hub for ½" conduit

Armored wire hub for #8 to #2 ground wire



...meet 30 different grounding requirements

Just combine the proper hub and clamp and you'll meet almost any grounding need

You can run *conduit-protected* ground wire through conduit from ½" to 1" . . . ground both conduit and wire to any water pipe from ½" to 6".

You can ground #8, 6 or 4 *armored* wire to the same range of pipe sizes. Just bolt an armored-wire hub to the right size clamp.

Or you can attach #8, 6 or 4 *bare* wire to the solderless grip on the clamp – no hub needed.

T & B hubs and clamps have built-in solderless connectors. They're easily installed with wrench or screwdriver. Teeth on hubs and clamps permit locking at any angle. Clamps can be used alone with bare ground conductor up to #4 wire . . . UL approved, meet 1951 NEC Code. And, like all T & B quality fittings, they're designed for lowest installed cost. Check for yourself—write for a free copy of Bulletin #65 covering the complete line of T & B cable and raceway fittings.

LOOK FOR THIS SIGN –

IT'S THE MARK OF AN AUTHORIZED T & B DISTRIBUTOR

The complete line of T & B fittings for conductors and raceways is sold only by recognized electrical wholesalers. It's our way of assuring you the service and savings of a friendly local source. Call him for all your electrical needs. T325

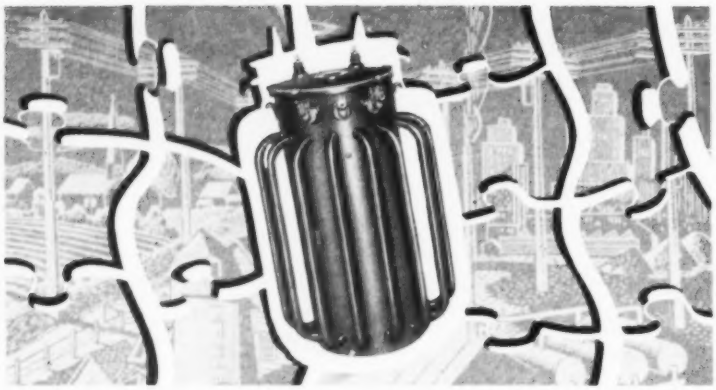
THE THOMAS & BETTS CO.

INCORPORATED

34 Butler Street • Elizabeth 1, New Jersey

Thomas & Betts Ltd., Montreal, P.Q., Canada

MANUFACTURERS OF FINE ELECTRICAL FITTINGS SINCE 1898



BRING YOUR TRANSFORMER PUZZLES TO *Standard*

PLANNING A TRANSFORMER INSTALLATION can become quite puzzling. But, the pieces fall easily in place when specially trained, experienced STANDARD engineers are called in and consulted. This service is available to you without cost. Call STANDARD today!

Standard
THE STANDARD TRANSFORMER COMPANY
WARREN, OHIO
REPRESENTATIVES IN PRINCIPAL CITIES

Rae, The J. H. McRae Co.; vice-chairman, K. Maude, Electric Power Equipment, Ltd.; treasurer, P. Wise, Mott Electric Co.; and secretary, B. H. Gallie, Marks Bros. Electric, Ltd.

• • • •

New Orleans Chapter met at Irwin's Restaurant, March 24 to elect new officers. New president is S. J. Stewart, S. J. Stewart (Electric). Other officers are: vice-president, Harry W. Mentrup, Nola Electric, Inc., and secretary-treasurer, William A. Dries, Bill Dries, Inc.

• • • •

Meeting in Buffalo, March 13, Niagara Chapter elected new officers for the coming year. They are: president, Henry Z. Lang, Lang Electric Co., Buffalo; secretary-treasurer, Ralph Barker, Barker Electric, Niagara Falls. Frank Egloff, Buffalo Electric, Buffalo; William G. Faltz, Wm. G. Faltz Electric Motors, Rochester; Donald E. Murray, Murray Electric Co., Syracuse; and John W. Schlehr, S-S Electric Repair Shop, Inc. are first, second, third and fourth vice-presidents respectively. Following elections the group heard a talk on collection methods by John Ryan, Merchant's Adjustment Bureau.

• • • •

Oregon Chapter also has new officers. They are: president, V. J. Hunt, Walker Electric Works; vice-president, Victor E. Weber, R. R. Poppleton, Inc.; and secretary, J. W. Morgan, C. E. Briggs, Inc. all of of Portland.

• • • •

At Louisville Chapter's Regular Monthly Meeting, April 9, Mayflower dining room, the following were elected to office for the 1952-53 term: president, Carl M. Grubbs, Electric Tool Service Co.; vice-president, George M. Ruf, J. George Electric Co.; secretary, William C. Krauth, Wm. C. Krauth Electric Co.; and treasurer, Owen W. Gollar, Owen Gollar Electric Co.

• • • •

New officers of the Great Lakes Chapter are: president, Walter Cohen, J-C Electric Motor Repair; vice-president, Charles E. Smith, J. E. Berger Corp.; treasurer, Charles H. Howard, Howard Electric Co.; and James Spaulding, Spaulding Electric Co. All officers are Detroit members. Charles E. Johnson will continue as the group's executive secretary. Past-president Bruce Palmer, Palmer Electric Co., Detroit, was presented with a plastic carrying case for suits by the chapter. Following the election and

business meeting, the chapter heard Clifford Alexander, U. S. Electric Motors. Alexander also showed the group a movie his company produced.

• • • •

Walter Kayser, Wayne Electric Co., Fort Wayne, is the new president of NISA's Indiana Chapter. Elected at the chapter's March meeting, he will serve during the coming term with vice-chairman John M. Foulke, Electric Motor Service Co., Indianapolis; treasurer Glenn F. Buschman, Kirby Risk Electric Motors, Inc., Lafayette; and secretary Burton A. Hannewald, Scherer Electric Co., Indianapolis.

Southwestern Chapter held its spring meeting at the Worth Hotel, Fort Worth, March 20-21, with approximately 60 members and guests attending. In addition to the regular business program, members heard talks on advertising by Ray Shelton, Brown & Bigelow Co., Fort Worth; atomic weapons by Dr. Ralph Clayton, a radiologist at a Dallas hospital; "New Business Using Class H Materials" by R. T. Anderson, a Dow Corning technical representative; "Collections and Credit" by T. P. Hendricks, Dun & Bradstreet; "Business Protection by Insurance" by Verne Garrison, a Fort Worth insurance executive and saw two films of the Bell Aircraft Corp.

• • • •

Wisconsin Chapter held elections recently and chose as their new president, R. H. Trester, Trester Service Electric Co., Milwaukee. Other officers are: first vice-president, Oliver E. Kemp, Electric Motor Service, West Bend, Wis.; second vice-president, John Bickler, Bickler Electric Co., West Allis, Wis.; secretary-treasurer, A. J. Kuzniewski, Quality Electric Service, Milwaukee. Al Schulz, Al Schulz & Son Electric Co., Milwaukee was elected to the executive board.

• • • •

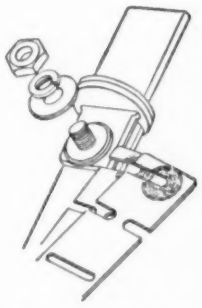
Sixty-eight members, wives and guests, including Executive Secretary Fred B. Wipperman were on hand for the Midwest Chapter's April 11 meeting at the Fontenelle Hotel, Omaha. The meeting, an all-day affair, convened at 9:30 A.M. with a business meeting, election of officers and open discussion of shop problems. A luncheon was held, courtesy of H. O. Hale, after which the large group heard a lecture on "Motor Circuit Performance" by W. J. Bergen, Jr., merchandise and export sales manager, Clark Controller Co. and saw a film, "Energy Is Our Business," produced by Westinghouse.

H. A. Holden gave the members a cocktail reception at the Blackstone Hotel before the meeting's banquet.

THE ELECTRICIAN WITH INSIDE KNOWLEDGE SPECIFIES

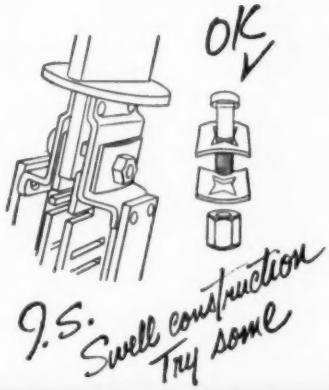
WARE HI-LAG FUSES

There is a great scientific and practical difference in renewable link fuses. WARE Hi-Lag FUSE superiority is winning happy new users...lowering plant maintenance costs...and winning more sales and good-will for the men who recommend them.



Men Who Know
STUDY FUSE PROBLEMS

When current flow is distributed over the extra wide end surfaces of WARE Hi-Lag links, the full current carrying capacity of the links is used. The widths of the knife blades and links match each other. Current is not converged into hot pressure spots as in old fuse designs which secures links against knife blades with pressure from a small diameter washer. With WARE Hi-Lag the entire end surface of the link is gripped in never loosening contact with the knife blade by means of an exclusive bridge assembly and extra wide spring-tension washers.



Men Who Know
STOP NEEDLESS BLOWS

Sure! Fuses are supposed to blow to give adequate protection, but poorly designed fuses blow long before they should! Link contact points in other fuses loosen and oxidation results due to expansion and contraction of metals and fibre during OFF and ON periods and cause excessive heating and unnecessary blows. Not only does exclusive WARE Hi-Lag design cut the number of dangerous contact points in half, but loose link contacts CANNOT HAPPEN in a WARE Hi-Lag! Large spring tension washers hold the link and knife blades in a solderless connection. The spring tension washer never loses tension . . . always locks the links safely into the circuit.

Write now for all the fuse facts
Ware Fuses Guaranteed to Meet the Severest Test
UNDERWRITERS APPROVED

Ware Fuse CORPORATION

4410 WEST LAKE STREET
CHICAGO 24, ILLINOIS

4 DITCH-WITCH Models
Digs 2" to 6" Trenches
Any Depth to 36"

A self-contained ditcher operating under its own power—digs clean even 2" to 6" trenches to a 36" depth. Light weight, mobile, low operating and maintenance costs.

DITCH-WITCH used in these Industries: Construction, Maintenance, Petroleum, Railroad, Electrical, Plumbing, Municipal

PROVED IN ALL SOILS

DITCH-WITCH digs as many feet of trench as machines four times its size. Pays for itself in a few days.

Write Today for Illustrated Literature

THE CHARLES MACHINE WORKS
624 B Street
PERRY, OKLAHOMA

Richards-Wilcox
Electric Door Operators
for Residential • Commercial Industrial Installations

• *Convenient*
• *Practical*
• *Efficient*

For complete information, ask your jobber or write for R-W catalog A-87.

RICHARDS WILCOX R-W AURORA Reg. U. S. Pat. Off.

Richards-Wilcox Mfg. Co.
A HANGER FOR ANY DOOR THAT SLIDES
150 Third Street • Aurora, Illinois

New officers of the Midwest Chapter elected at the meeting were: president, Leonard L. Egleston, Egleston Electric Co., Marshalltown, Iowa; vice-chairman, Harold Pedersen, Industrial Engineering Equipment Co., Davenport, Iowa; and secretary-treasurer, R. H. Longmore, Omaha Electrical Works, Omaha.

• • • •

The following new members have joined NISA since the last report: R. J. Nichols, Atomic Electric Co., Venice, Calif.; E. J. Brenner, Brenner Electric Service, Rochelle, Ill.; J. C. Gordon, Gordon Machine & Electric Co., Nowata, Okla.; and Carl F. Benfield, Randolph Electric Motor Co., Asheboro, N. C.

• • • •

Quaker City Chapter reports that at the April meeting William Pistone presented an analysis of the much discussed Philadelphia Mercantile Tax and Charles Trout, Brush Engineer, the United States Graphite Company gave a talk on the making of carbon and the manufacture of motor and generator brushes.

• • • •

The New England Chapter had its regular meeting April 9 at the Hotel Bradford, Boston. In the absence of president, the meeting was presided over by Vice-President Kolhonen.

The nominating committee reported and at this time their chairman turned the meeting over to Bert Whittemore, who conducted the election of the following officers: President—Edwin Kolhonen; Vice-President—Arthur Glines; Treasurer—Daniel MacDonald; Secretary—Fernard Rosenberg; Director — Two Years — Warren Crabbe; and Director—Three Years —A. S. Tracy.

LOBBY HUDDLE at Minneapolis electrical convention finds Cliff Irvin (left), W. A. Roosevelt Co., LaCross, Wis., and contractor E. V. Hicks, Rochester, Minn., discussing material supply situation.

To help you . . .

Install, maintain and operate electrical equipment

Here are hundreds of detailed descriptions, rules, methods, wiring and practical data.

NEW 7th EDITION

YOU'LL be able to solve every-day electrical problems right on-the-spot with the help of this guide. It gives you all the usable facts you need for the selection, installation, operation, care and proper application of electrical apparatus and materials. Contains complete data on wires and cables, splicing, installation and care of motors, capacitors, lighting equipment, the latest information on electron tubes and circuits and their application in industry. Imagine how much this information means to you . . . in increasing the number of jobs you can handle, in efficiency, advancement, and time, energy and effort saved.

Completely in line with the latest National Electrical Code

Just Out
AMERICAN ELECTRICIANS' HANDBOOK

by Terrell Croft
Revised by CLIFFORD C. CARR
1734 pages, 1327 illus., over 400 tables
$10.00

WITH this trouble-shooting book at your fingertips you'll see how quickly work problems can be simplified. In easy-to-understand language you are given the right facts in the way you want them . . . thoroughly indexed for quick finding. It covers everything from explanations and definitions of fundamentals to suggestions and ways for remedying the troubles of electrical equipment and maintaining high operating efficiency. It presents the kind of practical information that helps all practical electrical men—wiremen, contractors, linemen, plant superintendents, operators, construction engineers and others.

CONTENTS

- Fundamentals of Electricity
- Properties and Splicing of Conductors
- Circuit and Circuit Calculations
- General Electrical Equipment and Batteries
- Transformers
- Electron Tubes and Circuits
- Generators and Motors
- Outside Distribution
- Interior Wiring
- Electric Lighting
- Wiring Tables

10 DAYS' FREE EXAMINATION

McGRAW-HILL BOOK CO., Inc.
330 W. 42 St., NYC 36

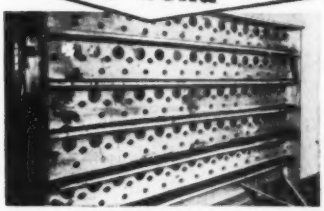
Send me Croft's **AMERICAN ELECTRICIANS' HANDBOOK** for 10 days examination on approval. In 10 days I will remit $10.00, plus a few cents delivery or return the book postpaid. (We pay for delivery if you remit with this coupon; same return privilege.)

(PRINT)
Name .....
Address .....
City ..... Zone.... State.....
Company .....
Position EC-6

This offer applies to U. S. only.

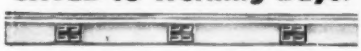
this test rack was built in only TWO DAYS

while this one took THREE WEEKS to build



PLUGMOLD 2000

SAVED 13 Working Days!



At The E. Ingraham Company — world famous clock manufacturers of Bristol, Conn. — PLUGMOLD 2000 has proved again that it is EASIER, FASTER, CHEAPER to install. Using Plugmold — two men built this timer test rack in 2 DAYS. It formerly took two men 3 WEEKS to build the same rack using old type construction with ordinary wiring.

Wiremold's famous Plugmold 2000 gives you SURFACE mounted raceways — no drilling and cutting for outlet boxes! Saves time, effort, money!

Write today for the full Plugmold story and the new Plugmold 2000 book!

WIREMOLD

Makers of
PLUGMOLD – multi-outlet systems
WIREMOLD – electrical raceways
PANCAKE – overfloor raceways

THE WIREMOLD CO.
Hartford 10, Connecticut

DATES AHEAD

Fourth National Store Modernization, Building and Maintenance Show—Madison Square Garden, New York City, June 9-12.

American Institute of Electrical Engineers—Summer general meeting, Atlantic City, N. J., June 29-July 3.

N. Y. State Electrical Contractors and Dealers, Inc.—Annual convention, Saranac Inn, Saranac Inn, N. Y., June 29-July 3.

Illuminating Engineering Society—Hotel Commodore, New York, N. Y., September 14-18.

International Association of Electrical Inspectors—25th Jubilee meeting, Edgewater Beach Hotel, Chicago, Ill., September 21-26.

National Electronics Conference—9th Annual conference, Hotel Sherman, Chicago, Ill., September 28-30.

Industrial Electric Exposition—Hotel William Penn, Pittsburgh, Pa., October 6-8.

Canadian Electrical Manufacturers Assn.—Annual meeting, General Brock Hotel, Niagara Falls, Ontario, Canada, September 23-25.

Second National Electrcial Industries Show—Sponsored by the Eastern Electrical Wholesalers' Association, 69th Regiment Armory, 26th St. & Lexington Ave., New York, N. Y., September 29-October 2.

National Electrical Manufacturers Assn.—Haddon Hall Hotel, Atlantic City, N. J., November 9-12.

National Electrical Contractors Association—Annual convention, Miami Beach, Florida, November 17-20.

EXPEDITING of materials to jobs in progress is facilitated through use of a large wall map of Winston-Salem, N. C. by J. W. "Walt" Speer, stock room superintendent, Salem Electric Co., of that city. One end of cloth tape is anchored in map at location of Salem Electric's offices and warehouse, distances to various job addresses readily measured with the tape, and trucks routed accordingly to jobs in proper sequence to save time and travel.

CHEAPER TO INSTALL

PLUGMOLD 2000 *with* **SNAPICOIL**

by **WIREMOLD**

1 RACEWAY FOR 3 WIRING SERVICES

1

For the first time, ONE raceway that's designed to take all 3 wiring services — NEMA grounded,

2

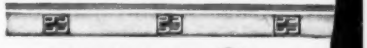
2-wire Duplex "hot", and 3-wire Duplex receptacles, *one side switched, one side "hot"* . . . cheaper, because only 1 raceway needs to be taken to the job!

3

. . . cheaper, too, because the pre-wired Snapicoil receptacles are readily intermixed or replaced by the skilled electrician . . . cheaper because cutting and fitting are reduced to a minimum.

Write today for the new, free Plugmold 2000 book!

PLUGMOLD 2000



WIREMOLD'S *New* multi-outlet system

THE WIREMOLD COMPANY
Hartford 10, Connecticut

MINERALLAC
Perforated
STRAP
Versatile Hanger Iron

Safely supports hanging pipes, conduits and cables up to 500 lbs. Made of ¾-in. 18 gauge electro-galvanized steel (also available in Everdur, copper, brass or aluminum). Precision made — perforations do not vary. ¼-in. holes on ½-in. centers. Comes in 10-ft. coils and 5 and 10-ft. straight lengths. Available in other lengths also.

Send for literature and prices

Specify **MINERALLAC** HANGERS, CLIPS, STRAPS, BUSHINGS

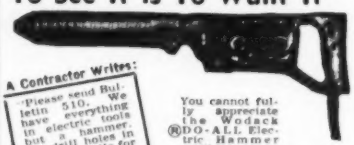
MINERALLAC ELECTRIC COMPANY
23 North Peoria Street
Chicago 7, Illinois

MINERALLAC

WHERE TO BUY

Equipment, Materials, Supplies and Services for Electrical Construction—Maintenance—Repairs

To See It is To Want It



A Contractor Writes:

"Please send Bulletin 510. We have everything in electric tools but a hammer. We drill holes in concrete walls for water and heating pipes. A builder in West Hartford has one of your hammers and we like it. That's why I am writing you."

You cannot fully appreciate the Wodack ®DO-ALL Electric Hammer until you use it or see a fellow contractor punch a hole-a-minute in concrete. It's a saver of manhours and pays for itself in a short time. From then on it pays you a nice profit. Don't delay. Ask for Bulletin 510-EC.

Wodack® Electric Tool Corp.
4627 W. Huron St. Chicago 44, Ill.

STOP *that* WATER

With FORMULA NO. 640, a clear liquid which penetrates 1" plus in concrete, brick, stucco, plaster, etc. Seals out water, dirt. Holds 20' head. Use outside and in. Preserves all absorbent materials. Sold 14 years. Quick, economical, sure. $3 in 55's. Free sample. See Sweet's.
HAYNES PRODUCTS CO. OMAHA 3, NEBR.

on parts for Brown & Brockmeyer • Century • Delco • General Electric • Jack & Heintz • Leland • Marathon • Packard • Redmond • Sunlight • Wagner • Westinghouse—*motors*

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The HARRY ALTER CO., Inc.
1728 S. Michigan Ave. Chicago, Illinois
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Also make certain you advise your local Post Master, so other important mail doesn't go astray. Both the Post Office and we will thank you for your thoughtfulness.

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ELECTRICAL CONSTRUCTION and MAINTENANCE

330 W. 42nd St. New York 18, N. Y.

Among the Manufacturers

Headquarters Announcements

General Electric Co., New York, N. Y.—Clarence H. Linder, vice president of engineering; Charles K. Rieger, vice president and general manager, Major Appliance Division; Willard H. Sahloff, general manager, Small Appliance Division.

Sylvania Electric Products, Inc., New York, N. Y.—Don G. Mitchell, chairman of the board of directors; H. Ward Zimmer, president; W. Benton Harrison, vice president in charge of finance.

Allis Chalmers Mfg. Co., Milwaukee, Wis.—David A. Griffith, assistant general manager, Pittsburgh Works; J. V. McGuire, sales manager, Switchgear Dept., George W. O'Keeffe and Clinton F. Kucera, assistant sales managers, Switchgear Dept.

National Electric Products Corp., Pittsburgh, Pa.—Joseph J. Gretter, Jr., service manager; Frank D. King, manager, Header Duct Section, Industrial Sales Dept.

Pittsburgh Standard Conduit Co., Etna, Pa.—Robert G. McIlroy, president.

Westinghouse Electric Corp., Pittsburgh, Pa.—Bruce D. Henderson, vice president in charge of purchases and traffic; William C. Rowland, vice president, Manufacturing and Repair Division; C. Swan Weber, vice president in charge of Washington office; Robin S. Kersh, vice president, Eastern District; Leslie E. Lynde, manager, Aviation Gas Turbine Division; Walter W. Wendelken, director of works engineering, Headquarters Manufacturing Division; Franklin P. Hinman, product manager, Electronic Tube Division.

Doerr Electric Corp., Cedarburg, Wis.—K. Blind, assistant to president.

General Electric Co., Schenectady, N. Y.—Clarence E. Burke, general manager, High Voltage Switchgear Dept.; H. Frank Hentschel, general manager, Medium Voltage Switchgear Dept.; Reginald H. Jones, general manager, Low Voltage Switchgear Dept.; F. H. Evans, manager of manufacturing, Welding Dept.

Ray-O-Vac Co., Madison, Wis.—E. A. Wright, general industrial sales manager.

Electric Regulator Corp., Norwalk, Conn.—Ahmed N. Sharif, production control supervisor.

Trade Wind Motorfans, Inc., Los Angeles, Calif.—George F. Sleight, sales manager.

National Electric Products announces its new address as 140 Stanwix St., Pittsburgh 22, Pa., in Pittsburgh's new Gateway Center.

Stonco Electric Products Co., Kenilworth, N. J., has purchased the Lighting Products Div. of M. B. Austin Co., Northbrook, Ill.

Merger of Federal Electric Products Co., Newark, N. J., and Pacific Electric Mfg. Corp., San Francisco, Calif., has been announced by the two companies.

Eutectic Welding Alloys Corp., Flushing, N. Y., announces formation of The Eutectic Welding Alloys Co. of Canada, Ltd.

B. F. Goodrich Co., Akron, O.—Ernest E. Haupt, manager of national accounts, Industrial Products Sales Department.

Keps Electric Co., Admiral Division, Pittsburgh, Pa.—Jack McNeff, sales manager, Major Appliances.

Regional Appointments

MIDDLE ATLANTIC

General Electric Co., William J. Woods, manager of Empire District, Syracuse, N. Y.

Graybar Electric Co., Inc.: J. P. McCarthy, district sales manager, New York; F. C. Sweeney, sales manager, Newark, N. J.; H. J. Fitzpatrick, sales manager, Albany, N. Y.

General Controls Co.: O. L. Liepin, branch manager, Philadelphia office.

International Resistance Co.: James G. Perkins, general manager, and Richard Johnson, assistant manager, Syracuse sales office.

Sterling Electric Motors, Inc.: Kenneth J. Plants, district manager, New York office.

SOUTH ATLANTIC

Barber-Colman Co.: Robert Lindsay, branch manager, Columbia, S. C.

EAST CENTRAL

Sterling Electric Motors, Inc.: Robert T. Dudley, Eastern Regional sales manager, Chicago, Ill.

WEST CENTRAL

Allis Chalmers Mfg. Co.: Edward A. Rensch, branch manager, Des Moines, Iowa.

WEST

Graybar Electric Co., Inc.: E. E. Leavy, branch manager, Salt Lake City; B. F. Keyfauver, branch manager, Phoenix, Arizona.

General Electric Co.: Edward M. Ellis, manager, Pacific Southwest District.

Sterling Electric Motors, Inc.: John R. Howell, Western Regional sales manager, Los Angeles, Calif.

SEARCHLIGHT SECTION

(Classified Advertising)

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$1.20 per line, minimum 3 lines. To figure advance payment count 5 average words as a line.
Position Wanted and Individual Selling Opportunity Wanted undisplayed rate is one-half of above rate, payable in advance.
Box Numbers in care of our New York, Chicago & San Francisco offices count as one additional line.
Discount of 10% if full payment is made in advance for 4 consecutive insertions.
Send New Advertisements to N. Y. Office, 330 W. 42nd St., N. Y., for July issue closing June 25th.

Equipment Wanted or For Sale Advertisements acceptable only in Displayed Style.
Individual Spaces with border rules for prominent display of advertisements.
The advertising rate is $11.00 per inch for all advertising appearing on other than a contract basis. Contract rates quoted on request.
An advertising inch is measured ⅞" vertically on one column. 3 columns—30 inches—to a page.

E.C.M.

FOR SALE

20,000' of 3 Conductor 2/0 Steel Taped Parkway Cable, Type RJFJ, 3000 V.
3,500' of 3 Conductor #2 Steel Taped Parkway Cable, Type RJFJ, 3000 V.
2—45 KVA, 2400 V. Primary 480/240 V. Secondary, 3 Phase, Dry Transformers
2—75 KVA, 2400 V. Primary 480/240 V. Secondary, 3 Phase, Dry Transformers
5—112½ KVA, 2400 V. Primary 480/240 V. Secondary, 3 Phase, Dry Transformers
3—100 KVA, 2300 V. Primary 460/230 V. Secondary, Single Phase, Oil Cooled Transformers
3—50 KVA, 2400 V. Primary 480/240 V. Secondary, Single Phase, Oil Cooled Transformers
3—100 KVA, 2400 V. Primary 480/240 V. Secondary, Single Phase, Oil Cooled Transformers
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450 ft.	Okonite	6 Pr. #19	PILC
481 ft.	Okonite	4 Pr. #16	PILC
910 ft.	West. Elec.	51 Pr. #19	PILC
890 ft.	West. Elec.	26 Pr. #19	PILC
500 ft.	Okonite	10/c #14	Neoprene Sheath WP Braid
1750 ft.	Okonite	5/c #14	Neoprene Sheath WP Braid
140 ft.	Gen. Cable	26 Pair	PILC
600 ft.	Okonite	10/c #14	Neoprene Sheath WP Braid
875 ft.	Okonite	10/Pr. #19	Okonite Okoprene Twisted in Pre.
225 ft.	Okonite	2/c #14	Rubber & Braid
1100 ft.	Okonite	4 Pr. #19	Okonite Okoprene Twisted in Pre.

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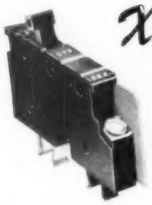

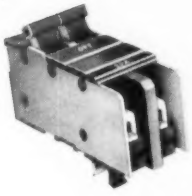

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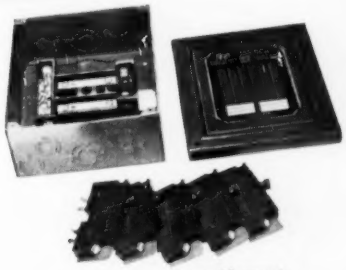

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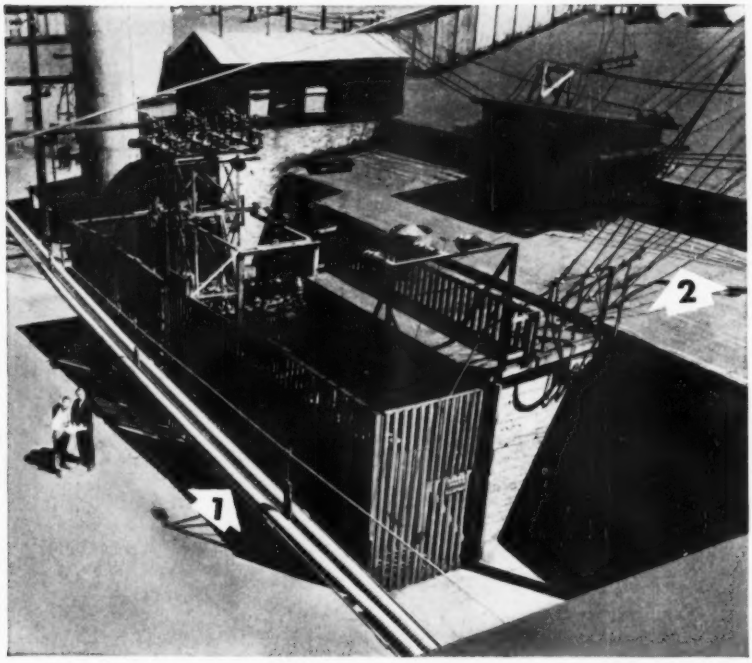

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You can reduce installation time and cut installation cost when you use the G-E V-c interlocked armor cable system.

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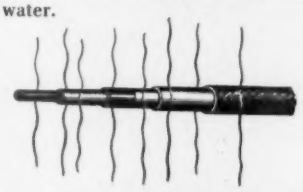

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